# THE GROVND OF ARTS.

TEACHING THE PERFECT worke and practise of Arithmeticke, both in whole Numbers and Fractions, after a more easie and exact forme then in former time hath beene set forth: Made by M. ROBERT RECORD D. *in Physick.*

*Afterward, augmented by* Mr. Iohn Dee.

And since enlarged with a Third part of Rules of Practise, abridged into a briefer method then hitherto hath been published, with diuers necessary Rules incident to the Trade of Merchandise: with Tables of the valuation of all Coynes, as they are currant at this present time: *By* IOHN MELLIS.

And now diligently perused, corrected, illustrated and inlarged; with an *Appendix* of figurate Numbers, and the Extraction of their Roots, according to the Method of *Christian Vrstitius*: with Tables of Board and Timber measure; and new Tables of *Interest* vpon *Interest*, after 10 and 8 *per* 100; with the true value of Annuities to be bought or sold present, Respited, or in Reuersion: the first calculated by *R. C.* but corrected, and the latter diligently calculated by *Robert Hartwell, Philomathemat.*

*Scientia non habet inimicum nisi ignorantem.*

Fide——sed——Vide.

*LONDON*,
Printed by THO. HARPER, for *Iohn Harison*, and are to be sold at his shop in Pater-noster Row, at the signe of the Vnicorne 1632.

THat which my friend hath well begun,
For very loue to Common weale,
Need not all whole to be new done,
But new encrease I doe reueale. A

Something herein I once redreſt,
And now againe for thy behoofe,
Of zeale I doe, and at requeſt,
Both mend and adde, fit for all proofe.

Of numbers vſe, the endleſſe might,
No wit nor language can expreſſe,
Apply and try both day and night,
And then this truth thou wilt confeſſe.

I. Dee.

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## The Bookes Verdict.

TO pleaſe or diſpleaſe ſure I am,
But not of one ſort to euery man:
To pleaſe the beſt ſort would I faine,
The froward diſpleaſe ſhall I certaine.
Yet wiſh I will, though not with hope,
All eares or mouthes to pleaſe or ſtoppe.



# TO THE MOST mighty Prince *Edward* the ſixth, by the grace of God, King of *England*, *France*, and *Ireland*, &c.



THe Excellency of mans nature being ſuch, as it is by Gods diuine fauour (moſt mighty Prince) not only created in highneſſe of degree farre aboue all other corporall things, but by perfection, reaſon and ſearch of wit, much approaching toward the Image of God, as not onely the holy Scriptures do teſtifie, but alſo thoſe naturall Philoſophers, which exactly did conſider the nature of man, and namely the far reach and infinite compaſſe of the works of the minde, were inforced to confeſſe, that man ſcarſely was able to know himſelfe. And if he would duely ponder the nature of himſelfe, he would find it ſo ſtrange, that it might ſeeme vnto him a very miracle. And thereof ſprang that ſaying: *Magnum miraculum eſt homo, maximum miraculum ſapiens homo.* For vndoubtedly, as man is one of the greateſt miracles that euer God wrought, ſo a wiſe man is plainly the greateſt.

And therefore was it that ſome did account the head of a man the greateſt miracle in the world, becauſe not onely of the ſtrange workmanſhip that is in it, but much more of the efficacie of reaſon, wit, memory, imagination, and ſuch other powers, and workes of the minde, which can more eaſily conceiue any thing in a manner, then vnderſtand it ſelfe. Amongſt all the creatures of God, it findeth none more difficult to be perceiued then theſe ſame powers of it ſelfe; whereby it doth conceiue and iudge: as it may be well coniectured by the diuerſity of opinions, that the wiſeſt Philoſophers did vtter touching the ſpirit of man, & the ſubſtance of it: whereof, I now intend to make no rehearſall; but whoſo liſteth to

read thereof, may finde it largely set forth, not onely in *Aristotle* his bookes, *De anima*, but also in *Galene*, his booke called *Historia Philosophica*: and againe in *Plutarch* his worke, *De Philosopherum placitis*, whose words are also repeated of *Eusebius* in the xv booke, τῆς διαγγλικῆς προπαρασκευῆς, vnto whom I remit them that haue desired to vnderstand intricate difficulty of knowing our owne selues, as touching our best part, and that part whereby we deserue to beare the name of men.

This matter seemed so obscure and difficult in knowledge, that *Galen*, who for his excellent wisedome and iudgement in naturall works, is called of many men a Miracle in nature, yet in searching the nature and substance of the spirit of man, he not onely confesseth himselfe ignorant, but counteth it plaine temerity to attempt to finde it. So farre aboue the hope of mans knowledge is that part, whereby man doth know and iudge of things. And although the ignorant sort (which hate all things that they know not) do little esteeme the profoundnesse of mans spirit and of reason, the chiefe power and faculty of it: yet as there is a kinde of feare and obedience of vnreasonable Beasts vnto man, by the working power of God, so is there in those small reasoned persons, a certaine kinde of reuerence toward wisedome and reason, which they do shew oftentimes, and by power of perswasion, are inforced to obey reason, will they nill they.

And hereby came it to passe, that the rudenesse of the first age of Man was brought vnto some more ciuill trade, as it is well declared by *Cicero*, in the beginning of his first booke, *De inventione Rhetorica*, where he saith thus: *Nam fuit quoddam tempus quum in agris homines passim bestiarum more vagabantur, & sibi victu ferino vitam propagabant, nec ratione animi quicquam, sed pleraq; viribus corporis administrabant. Nondum diuinæ religionis, non humani ratio colebatur. Nemo legitimas viderat nuptias, non certos quisquam inspexerat liberos; non ius æquabile quid vtilitatis haberet, acceperat: ita propter errorem atq; insitiam, cæca ac temeraria dominatrix animi cupiditas, ad sẽ explendam viribus corporis abutebatur, pernicioſiſſimis ſatellitibus. Quo tempore*

*pore quidam, magnus videlicet vir & ſapiens, cognouit quæ materia eſſet, & quanta ad maximas res opportunitas in animis ineſſet hominum, ſi quis eam poſſit elicere, & præcipiendo meliorem reddere. Qui diſperſos homines in Agris, & in tectis ſyluſtribus abditos, ratione quadam compulit in vnum locum, & congregauit: & eos in vnamquamq; rem inducens vtilem atq; honeſtam, primò proper inſolentiam reclamantes, deinde propter rationem atq; orationem ſtudioſiùs audientes, ex feris & immanibus, mites reddidit, & manſuetos.*

This long repetition of *Tullyes* words will ſeeme tedious to them that loue but little, and care much leſſe for the knowledge of reaſon, but vnto your Maieſty (I dare ſay) it is a delectable remembrance, and vnto me it ſeemed ſo pleaſant, that I could ſcarce ſtay my pen from writing all that mine eyes did ſo greedily reade.

This ſentence of *Cicero* am I loath to tranſlate into Engliſh, partly for that vnto your Maieſty it needeth no tranſlation, but eſpecially knowing how far the grace of *Tullyes* Eloquence doth excell any Engliſhmans tongue, and much more exceedeth the baſeneſſe of my barbarous ſtyle: yet for the fruite of the ſentence, I had rather vnto my meere Engliſh countrimen vtter the rudeneſſe of my tranſlation, then to defraud them the benefit of ſo good a leſſon; truſting they will ſo learne to loue reaſon, that they will alſo gladly and greedily embrace all good Sciences, that may helpe to the iuſt furniture of the ſame, when they conſider that informed reaſon was the onely inſtrument, or at leaſt the chiefeſt meanes to bring men into ciuill regiment, from barbarous manners, and beaſtly conditions.

"For the time was (ſaith *Tully*) that men wandred a-
"broad in the fields vp and downe like beaſts, and vſed
"no better order in feeding then they; ſo that by reaſons
"rule they wrought nothing, but moſt of their do-
"ings did they atchieue by force of ſtrength. At this
"time there was no iuſt regard of religion toward God,
"nor of duty toward man. No man had ſeen right vſe of
"marriage, neither did any man know their owne chil-
"dren from other; nor no man had felt the commodi-
"ty of iuſt Laws: ſo that through error and ignorance,
"wilfull luſt, like a blinde and heady ruler, abuſed bodi-

"ly ſtrength as a moſt mortall miniſter for the ſatisfy-
"ing of his deſire. At that time was there one which
"not onely in power, but alſo in wiſedome was great,
"and hee conſidered how that in the mindes of men
"was both apt inſtruments, and great occaſion to the
"due accompliſhment of moſt weighty affaires, if a man
"could apply them to vſe, & by teaching of rules frame
"them to better trade. This man with perſwaſion of
"reaſon gathered into one place the people that were
"wandring about the fields, and lay lurking in wilde
"cottages and woods, & bringing them into one com-
"mon ſociety, did trade them to all ſuch things, as either
"were profitable or honeſt, although not without re-
"pining at the firſt, by reaſon that they had not been ſo
"accuſtomed before. Yet at length through reaſon and
"perſwaſion of words they obeyed him more diligent-
"ly, and ſo of a wilde and cruell people, he made them
"curteous and gentle.

Thus hath *Tully* ſet forth the efficacie of reaſon and perſwaſion, how it was able to conuert wilde people to a mildneſſe, and to change their furious cruelneſſe into gentle curteſie: were it not now a great reproach in this our time (when knowledge raigneth ſo large) that men ſhould ſhew themſelues leſſe obſequious to reaſon? Vnleſſe it may be thought, that now euery man hauing ſufficient knowledge of himſelfe, needeth not to hearken to the perſwaſion of others.

Indeed he that thinketh himſelf wi'e, will not eſteeme the reaſon of any other, be he neuer ſo wiſe; ſo that of ſuch a one it may well be ſaid: Hee that thinketh himſelfe wiſer then he is, may iuſtly bee counted a double foole. Wherefore ſuch men are not to be permitted in open audience to talke, but muſt be put to ſilence, and be made to giue eare to reaſon; which reaſon conſiſteth not in a multitude of words heaped raſhly together, and applied for one purpoſe, but reaſon is the expreſſing of a iuſt matter with witty perſwaſions furniſhed with learned knowledge: ſuch knowledge had *Moſes*, being expert in all learning of the Egyptians, as the Scriptures declare, & therefore was able to perſwade the ſtubborne

people

people of the Iewes, although not without paine. Such knowledge and such reasons did *Druys* shew, which was the first Law-maker of all the West part of Europe. Like reason and wisedome did *Xamolxis* vse amongst the Gothes: *Lycurgus* vnto the Lacedmonians, *Zeleucus* to the Locrians, *Solon* to the Athenienses, & *Dunwallo Molmutius* two thousand yeeres past amongst the old Britains of this Realme. And hereby came it to passe, that their Lawes continued long, till more perfect reason altered many of them, and willfull power oppressed most of thé.

Druis was sonne to King Sarron, and succeeded him in his kingdome.

At the beginning when these wise men perceiued how hard it was to bring the rude people to vnderstand reason, they iudged the best meanes to attaine this honest purpose to depend of learning in euery kind: for by learning (as *Ouid* saith:) *Pectora mollescunt asperitasque fugit* Stout stomackes doe waxe milde, and sharpe fiercenesse is exilde. Therefore as *Berosus* doth testifie, *Sarron* that was the third King ouer all this West part of Europe for to bring the people from beastly rage to manly reason, did erect Schooles of liberall Arts, which tooke so good successe, that his name continued in that sort famous aboue two thousand yeeres, after: for *Diodorus Siculus* which was in the time of *Julius Cæsar*, maketh mention of the learned men or Gothes of Celtes, and nameth them *Sarronides*, that is to say, *Sarron his Scholers and followers.*

Among these Arts that then were taught, some did informe the tongue, and make them able both to vtter aptly their mind, and also to perswade; as Grammar, Logicke, and Rhetoricke, although not so curiously as in this time; some other did appertaine to the iust order of partition of lands, the true vsing of weights, measures & reckonings in al sorts of bargaines, and for order of building and sundry other vses; those were Arithmeticke & Geometry. Againe, to incourage men to the honor of God, they taught Astronomy, whereby the wonderfull workes of God were so manifestly set forth, that no mans tongue nor penne can in like sort expresse his infinite power, his vnspeakeable wisedome, and his exceeding goodnesse toward man, whereby he doth bountifully

prouide for man all neceſſaries, not only to liue, but alſo to liue pleaſantly. And ſo was their confidence in Gods prouidence ſtrongly ſtayed, knowing his goodneſſe to be ſuch, that he would helpe man as he could, & his power to be ſo great, that he could doe what hee would: and thirdly his wiſedome to be ſo pure, that hee would doe nothing, but that that was beſt. Beſide theſe Sciences they taught alſo Muſicke, which moſt commonly they did apply partly to religious Seruices, to draw men to delight therein, & partly to ſongs made of the manners of men, in praiſe of Vertue, and diſcommendation of Vice, whereby it came to paſſe, that no man would diſpleaſe them, nor doe any thing euill that might come to their hearing: for their ſongs did make euil men more abhorred in that time than any excommunication doth in this time. The poſterity of theſe Muſitians continue yet both in Wales and Ireland, called *Bardes* vnto this day, by the ancient name of *Bardus*, their firſt founder.

This Bardus Druidius the 5 King of the Celtes, reigned 69 yeeres, and died 1832 yeeres before Chriſt.

And as theſe Sciences did encreaſe, ſo did Vertue encreaſe thereby. Againe, as thoſe Sciences did decay, ſo vertue loſt her eſtimation, and conſequently was little in vſe: whereof to make a full declaration were a thing meete for a Prince to heare, but it would require a peculiar Treatiſe. Wherefore at this preſent I count it ſufficient lightly to haue touched this matter in generall words, and to ſay no more of the particularity thereof, but onely touching one of thoſe Sciences, that is, *Arithmetick*, by which not onely iuſt partition of lands was made, but alſo touching buying and ſelling, all Aſſiſes, Weights, and Meaſures were deuiſed, and all reckonings and accounts driuen; yea by proportion of it were the true orders of Iuſtice limited, as *Ariſtotle* in his Ethicks doth declare, and the degrees of eſtates in the commonwealth eſtabliſhed. Although that proportion be called Geometricall, and not Arithmeticall, yet doth that proportion appertaine to the Art of Arithmeticke, and in Arithmeticke is taught the progreſſion of ſuch proportions, & all things thereto belonging. Wherefore I may well ſay, that ſeeing Arithmeticke is ſo many waies needefull vnto the firſt planting of a Common-

wealth,

wealth, it must needs be as much required to the preseruation of it also, for by the same meanes is any Cõmonwealth continued, by which it was erected & established. And if I shall in small matters in appearance, but indeed very waighty, put one example or two. What shall we say for the Statutes of this Realme, which be the onely stay of good order in manner now? As touching the measuring of ground by length and breadth, there is a good & an ancient Statute made by Art of Arithmeticke, and now it shall be to little vse, if by the same Art it be not practised and tried. For the assise of Bread and Drinke, the two most common and most necessary things for sustentation of man, there was a goodly ordinance in the Law made, which by ignorance hath so growne out of knowledge and vse, that few men do vnderstand it, & therefore the Statute bookes wonderfully corrupted, and the Commons cruelly oppressed: notwithstanding some men haue written, that it is too doubtfull a matter to execute those assises by those Statutes, by reason they depend of the standerd of the coyne, which is much changed from the state of that time, when those Statutes were made. Thus shall euery man read (that listeth) in the Abridgement of the Statutes, in the title of Weights and Measures, in the seuenth number of the English Booke, where hee should haue translated a good ordinance which is set forth in the French booke: but no maruell if the Abridgement doth omit it, seeing the great Booke of Statutes doth omit the same Statute as it hath done diuers other very good Lawes. And this is the fruit of ignorance, to reiect & condemne all that it vnderstandeth not, although they vse some cloakes for it: but such cloakes as being allowed, might serue to repell all good Lawes, which God forbid.

Againe, there is an ancient order for Assise of fire, Wood and Coales, which was renued not many yeeres past; and now how Auarice and Ignorance doth cauase that Statute, it is too pittifull to talke of, and more miserable to feele.

Furthermore, for the Statute of Coynage, and the Standred thereof, if the people vnderstood rightly the Statute,

Statute, they ſhould not, nor would not (as they often doe) gather an excuſe for their folly thereby: but as I ſaid, theſe Statutes by wiſdome and good knowledge of Arithmeticke were made, and by the ſame muſt they be continued. And let ignorance no more meddle with the vſe of them, than it did with the making of them. Oh in how miſerable caſe is that Realm, where the miniſters & interpreters of the Law are deſtitute of all good Sciences, which be the Keyes of the Lawes. How can they either make good Lawes, or maintaine them, that lacke that true knowledge whereby to iudge them? And happy may that Realme bee accounted, where the Prince himſelfe is ſtudious of learning, and deſireth to vnderſtand equity in all Lawes Therefore moſt happy are we the louing Subiects of your Maieſty, which may ſee in your Highneſſe not only ſuch towardneſſe, but alſo ſuch knowledge of diuers Arts, as ſeldome hath beene ſeene in any Prince of ſuch yeeres, whereby we are enforced to conceiue this hope certainly, that he which in thoſe yeeres ſeeketh knowledge, when knowledge is leaſt eſteemed, and of ſuch an age can diſcerne them to bee enemies both to his Royall perſon, and to his Realmes, which labour to withdraw him from knowledge, to exceſſiue paſtime, and from reaſonable ſtudy, to idle or noyſome pleaſures, he muſt needs, when hee commeth to more mature yeeres, bee a moſt prudent Prince, a moſt iuſt Gouernour, and a right Iudge, not onely of his Subiects commonly, but alſo of the miniſters of his Lawes, yea, and of the Lawes themſelues: and to bee able to conceiue the true equity & exact vnderſtanding of all his Lawes and Statutes, to the comfort of his good Subiects, and the confuſion and reproach of them which labor to obſcure or peruert the equity of the ſame Laws and Statutes. How ſome of theſe Statutes may be applyed to vſe, as well in this our time, as in any other time, I haue peculiarly declared in this Booke, and ſome other I haue omitted for iuſt conſiderations, till I may offer them firſt vnto your Maieſty, to weigh them, as to your Highneſſe ſhall ſeeme good: for many things in them are not to be publiſhed without your Highneſſe knowledge

knowledge and approbation, namely, because in them is declared all the rates of alloyes for all standards from one ounce vpward, with other mysteries of mint matters, and also most part of the varieties of coynes that haue beene currant in this your Maiesties Realme by the space almost of six hundred yeares last past, and many of them that were currant in the time that the Romanes ruled here.

All which with the ancient description of England and Ireland, and my simple censure of the same, I haue almost completed to be exhibited to your Highnesse. In the meane season most humbly beseeching your Maiesty to accept this simple Treatise, not worthy to be presented to so high a Prince, but that my lowly request to your Maiesty is, that this amongst other of my bookes may passe vnder the protection of your Highnesse, whom I beseech God most earnestly and daily, according to my duty, to aduance in all honour, and Princely Regalty, and to increase in all knowledge, iustice, and godly policy. Amen.

Your Maiesties most obedient Subiect and seruant,

ROBERT RECORD.

TO

# TO THE LOVING Readers: the Preface of Mr. Robert Record.

*SOre oft times haue I lamented with my selfe the vnfortunate condition of England, seeing so many great Clerks to arise in sundry other parts of the world, and so few to appeare in this our Nation: whereas for pregnancy of naturall wit (I thinke) few Nations do excell Englishmen. But I cannot impute the cause to any other thing, than to the contempt or misregard of learning. For as Englishmen are inferiour to no men in mother wit, so they passe all men in vaine pleasures, to which they may attain with great paine and labour: and are as slacke to any neuer so great commodity, if there hang of it any painfull study or trauelsome labour.*

*Howbeit, yet all men are not of that sort, though the most part be, the more pity it is: but of them that are so glad, not only with painfull study, & studious paine to attain learning, but also with as great study and paine to communicate their learning to other, and make all England (if it might be) partakers of the same; the most part are such, that vnneth they can support their owne necessary charges, so that they are not able to beare any charges in doing of that good, that else they desire to do.*

*But a greater cause of lamentation is this, that when learned men haue taken paines to do things for*

*the*

the aid of the vnlearned, scarce they shall be allowed for their well-doing, but derided and scorned, and so vtterly discouraged to take in hand any like enterprise againe. So that if any be found (as there are some) that do fauour learning, & learned wits, and can be content to further knowledge, yea onely with their word; such persons though they be rare, yet shall they encourage learned men to enterprise some thing at the least that England may reioyce of. And I haue good hope that England will (after she hath taken some sure taste of learning) not onely bring forth more fauourers of it, but also such learned men that she shall be able to compare with any Realme in the world. But in the meane season, where so few regarders of learning are, how greatly they are to be esteemed that do fauour and further it, my pen will not suffice at full to declare.

Therefore gentle Reader, whereas I do vpon most iust occasion iudge, yea and know assuredly, that there be some men in this Realme, which both loue and also much desire to further good learning, and yet am not wel able to write their condigne praise for the same, I thinke it better with silence to ouerpasse it, then either say too little of it, or to prouoke against them the malice of such other, which do nothing themselues that is praise-worthy, and therefore cannot abide to heare the praise of any other mans good deed.

And considering their great fauour vnto learning, though I my selfe be not worthy to be reckoned in the number of great learned men, yet am I bold to put my selfe in Presse, with such ability as God hath

hath lent me, though not with ſo great cunning as many men, yet with as great affection as any man, to help my Country-men, and will not ceaſe daily, (as much as my ſmall ability will ſuffer me) to endite ſome ſuch thing, that ſhall be to the inſtruction, though not of learned men, yet at the leaſt of the vulgar ſort, whoſe argument alwayes ſhall be ſuch as it ſhall delight all learned wits; though they do not learne any great things out of it.

But to ſpeak of this preſent book of Arithmetick, I dare not, nor will not ſet it forth with any words, but remit it to the iudgement of all gentle Readers, and namely, ſuch as loue good learning, beſeeching them ſo to eſteeme it, as it doth ſeeme worthy. And ſo either to accept the thing for it ſelfe, either at the leaſt to allow my good endeuour. But I perceiue I need not vſe any perſwaſions vnto them, whoſe gentle nature and fauourable mind is ready to receiue thankfully, and interpret to the beſt all ſuch enterpriſes attempted for ſo good an end, though the thing do not alwaies ſatisfie mens expectation. This conſidered, did bolden me to publiſh abroad this little book of the Art of numbring, which if you ſhall receiue fauourably, you ſhall encourage me to gratifie you hereafter with ſome greater thing.

And as I iudge ſome men of ſo louing a minde to their native Country, that they would much reioyce to ſee it proſper in good learning, and wi[illegible] Arts; ſo I hope well of all the reſt of Engliſhmen, that they will not bee vnmindfull of his due praiſe, by whoſe meanes they are helped and furthered in any thing. Neither ought they to eſteeme this thing

Elizabeth Philippes

*of ſo little value, as many men of little diſcretion oftentimes doe. For who ſo ſetteth ſmall price by the witty deuice and knowledge of numbring, be little conſidereth it to be the chiefe point, (in manner) whereby men differ from all brute beaſts: for as in all other things (almoſt) Beaſts are partakers with vs, ſo in numbring we differ cleane from them, and in manner peculiarly, ſith that in many things they excell vs againe.*

The Foxe in crafty wit exceedeth moſt men,
A Dogge in ſmelling hath no man his peere
To foreſight of weather if you looke then,
Many beaſts excell men; this is cleere.
The wittineſſe of Elephants doth letters attaine,
But what cunning doth there in the Be remaine?
The Emmet foreſeeing the hardneſſe of Winter,
Prouideth victualls in time of Summer.
The Nightingale, the Linet, the Thruſh, the Larke,
In Muſicall harmony paſſe many a Clarke.
The Hedghogge of Aſtronomy ſeemeth to know,
And ſtoppeth his Caue where the wind will blow.
The Spider in weauing ſuch Art doth ſhow,
No man can him mend, nor follow I trow.
When a houſe will fall, the Mice right quicke,
Flee thence before; can man doe the like?

*Many things elſe of the wittineſſe of Beaſts and Birds might I here ſay, ſaue that another time of them I intend to write wherein they excell in manner al men, as it is daily ſeen: but in nũber was there neuer beaſt found ſo cũning, that could know or diſcerne one thing from many, as by daily experience you may well conſider, when a Bitch hath many whelps, or a Hen many chickens: & likewiſe of other whatſoeuer they be; take from them all their young*

*ſauing*

*saying onely one, and you shall perceiue plainly, that they misse none, though they will resist you in taking them away, and will seeke them againe if they may know where they be, but else they will neuer misse them truly; but take away that one that is left, and then will they cry & complaine: and restore to them that one, then are they pleased againe. So that of number, this may I iustly say, it is the onely thing almost that separateth man from beasts. He therefore that shall contemne number, declareth himselfe as brutish as a beast, & vnworthy to be counted in the fellowship of men. But I trust there is no man so foule ouer-seene, though many right smally doe it regard.*

Why the Author wrot in Dialogue wise.

*Therefore will I now stay to write against such, and returne againe to this my Booke, which I haue written in the forme of a Dialogue, because I iudge that to be the easiest way of instruction, when the Scholler may aske euery doubt orderly, and the Master may answer to his question plainly.*

*Howbeit I thinke not the contrary, but as it is easier to blame another mans worke, then to make the like, so there will be some that will find fault, because I write in a Dialogue: but as I coniecture those shall be such as doe not, cannot, or will not perceiue the reason of right teaching, and therefore are vnmeet to be answered vnto, for such men with no reason will be satisfied.*

*And if any man obiect, that other Bookes haue him written of* Arithmetick *already so sufficiently, that I needed not now to put Pen to the Booke, except I will condemne other mens writings: to them*

*I an-*

*I answer: That as I condemne no mans diligence, so I know that no one man can satisfie euery man: and therefore like as many do esteeme greatly other Bookes, so I doubt not but some will like this my Booke aboue any other English Arithmeticke hitherto written; and namely, such as shall lacke instructers, for whose sake I haue so plainly set forth the Examples, as no Booke that I haue seene hath done hitherto: which thing shall be great ease to the rude Readers.*

*Therefore (gentle Reader) though this Booke can be but small aid to the learned sort, yet vnto the simple ignorant (which needeth most help) it may be a good furtherance and meane vnto knowledge.*

*And though vnto the King his Maiesty primarily I do it dedicate, yet I doubt not (such is his clemency) but that he can be content, yea, and much desirous, that all his loning Subiects shall take the vse of it, and imploy the same to their most profit: Which thing if I perceiue that they thankefully do, and receiue with as good will as it was written, then will I shortly with no lesse kindnesse set forth such introductions into Geometry and Cosmography, as I haue at times promised, and as hitherto in English hath not beene interprised, wherewith I dare say all honest hearts will be pleased, and all studious wits greatly delighted.*

*I will say no more, but let euery man iudge as he shall see cause. And thus for this time I will stay my Pen, committing you all to that true fountaine of perfect number, which wrought the whole world by number and measure: he is Trinity in Vnity, and Vnity in Trinity: To whom be all praise, honor, and glory.* Amen.

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*The*

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*and one of the neceſſarieſt rules that appertaineth to buying and ſelling, &c.* p.479

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*The fourteenth Chapter entreateth of exchanging of money from one place to another, with diuers neceſſary queſtions incident thereunto.* p. 521

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*them may easily be brought to money sterling.* p. 530

*The sixteenth Chapter containeth a briefe note of the ordinary Coynes of most places of Christendome for trafficke, and the manner of their exchanging from one City or Towne to another, which knowne, the Italians call* Parie: *whereby they finde the gaine or losse vpon the exchange.* p. 537

*The seuenteenth Chapter containeth also a declaration of the diuersity of the weights and measures of most places in Christendome for traffique, proportionated in equality one to another, as also vnto our English measure and weight, whereby the ingenious practitioner may easily reduce the weight and measure of each countrey into another.* p. 542

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*Two Tables, the firſt of the agreement of the Weights, the other of the Meaſures of moſt places of* Europe *for trafficke, whereby, through the aide of the Rule of three the ingenious may eaſily reduce our meaſure to a perfect valuation of other Countries Meaſure or weight, & likewiſe theirs to ours.* p. 551

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Before



# Before the Introduction of Arithmeticke, it were very good to haue ſome vnderſtanding and knowledge of theſe Figures and Notes.

| | | | | | |
|---|---|---|---|---|---|
| i | 1 | *one.* | xx | 20 | *twenty* |
| ii | 2 | *two.* | xl | 40 | *forty* |
| iii | 3 | *three.* | l. | 50 | *fifty* |
| iiii | 4 | *foure.* | lx. | 60 | *ſixty* |
| v | 5 | *fiue.* | lxx. | 70 | *ſeuenty* |
| vi | 6 | *ſix.* | xc. | 90 | *ninety* |
| vii | 7 | *ſeuen.* | C. | 100 | *a hundred.* |
| viii | 8 | *eight.* | CC. | 200 | *2 hundred.* |
| ix | 9 | *nine.* | D. | 500 | *5 hundred.* |
| x | 10 | *ten.* | DC. | 600 | *6 hundred.* |
| xi | 11 | *eleuen.* | M. | 1000 | *a thouſand.* |
| xii | 12 | *twelue.* | MD | 1500 | *a thou 5.hund.* |
| &c. | &c. | &c. | &c. | &c. | &c. |

A Dia-

# A Dialogue betweene the Maſter and the Scholar: teaching the ART and vſe of Arithmeticke with Pen.

*The Scholar ſpeaketh.*

*SIR, ſuch is your authority in mine eſtimation, that I am content to conſent to your ſaying, and to receiue it as truth, though I ſee none other reaſon that doth leade mee thereunto: whereas elſe in mine owne conceit appeareth but vaine, to beſtow any time priuately in learning of that thing, that euery child may, and doth learne at all times and houres, when hee doth any thing himſelfe alone, and much more when he talketh or reaſoneth with others.*

Maſter. Loe, this is the faſhion and chance of all them that ſeeke to defend their blinde ignorance, that when they thinke they haue made ſtrong reaſon for themſelues, then haue they proued quite contrary. For if numbring be ſo common (as you grant it to bee) that no man can doe any thing alone, and much leſſe talke or bargaine with other, but

he

he shall still haue to doe with number: this proueth not number to be contemptible and vile, but rather right excellent and of high reputation, sith it is the ground of all mens affaires, so that without it no tale can be told, no communication without it can be continued, no bargaining without it can duely be ended, or no businesse that man hath, iustly completed. These commodities, if there were none other, are sufficient to approue the worthinesse of number. But there are other innumerable, farre passing all these, which declare number to exceed all praise. Wherefore in all great workes are Clerkes so much desired? Wherefore are Auditors so richly fed? What causeth Geometricians so highly to be enhaunsed? why are Astronomers so greatly aduanced? because that by number such things they finde, which else would farre excell mans minde.

Scholar. Verily Sir, if it be so, that these men by numbring, their cunning do attaine, at whose great workes most men doe wonder, then I see well I was much deceiued, and numbring is a more cunning thing then I toke it to be.

Master. If number were so vile a thing as you did esteeme it, then need it not to be vsed so much in mens communication. Exercise Number, and answer to this question: how many yeares old are you?

Scholar:

Scholar. Mum.

Master. How many dayes in a weeke? How many weekes in a yeare? What lands hath your Father? How many men doth hee keepe? How long is it since you came from him to me?

Scholar. Mum.

Master. So that if number want, you answer all by Mummes: How many miles to London?

Scholar. A poake full of plummes.

Master. Why, thus you may see, what rule number beareth, and that if number be lacking, it maketh men dumbe, so that to most questions they must answer Mum.

Scholar. This is the cause (sir) that I judged it so vile, because it is so common in talking every while: For plenty is not daintie, as the common saying is.

Master. No, nor store is no sore: perceive you this? The more common that the thing is, being needfully required, the better is the thing, and the more to be desired. But in numbring, as some of it is light and plaine, so the most part is difficult, and not easie to attaine. The easier part serueth all men in common, and the other part requireth some learning. Wherefore as without numbring a man can doe almost nothing, so with the helpe of it you may attaine to all things.

Scholar. Yea sir, why then it were best to learne

learne the Art of numbring, first of all other learning, and then a man need learne no more, if all other come with it.

Master. Nay, not so: but if it be first learned, then shall a man be able (I meane) to learne, perceiue, and attaine to other Sciences; which without it he could neuer get.

Scholar. I perceiue by your former words that Astronomy and Geometry depend much on the helpe of numbring: but that other Sciences, as Musicke, Physicke, Law, Grammer, and such like, haue any helpe of Arithmeticke, I perceiue not.

Master. I may perceiue your great Clerklinesse by the ordering of your Sciences: but I will let that passe now, because it toucheth not the matter that I intend, and I will shew you how Arithmeticke doth profit in all these somewhat grosly, according to your small understanding, omitting other reasons more substantiall.

First (as you reckon them) Musicke hath not onely great helpe of Arithmeticke, but is made, and hath his perfectnesse of it: for all Musicke standeth by number and proportion: And in Physicke, before the calculation of criticall dayes, with other things, which I omit, how can any man iudge the pulse rightly, that is ignorant of the proportion of Numbers?

Musick.

Phisicke.

And as for the Law, it is plaine, that the man

Law.

man that is ignorant of Arithmeticke, is neither meet to be a Iudge, neither an Aduocate, nor yet a Proctor. For how can he well vnderstand another mans cause, appertaining to distribution of goods, or other debts, or of sums of money, if he be ignorant of Arithmeticke? This oftentimes causeth right to bee hindered, when the Iudge either delighteth not to heare of a matter that he perceiueth not, or cannot iudge for lacke of vnderstanding: this commeth by ignorance of Arithmeticke.

Now, as for Grammer, me thinketh you should not doubt in what it needeth number, sith you haue learned that Nounes of all sorts, Pronounes, Verbes, and Participles are distinct diuersly by numbers: besides the variety of Nounes of Number, and Aduerbes. And if you take away number from Grammer, then is all the quantity of Syllables lost. And many other wayes doth number helpe Grammer. Whereby were all kinds of Meeters found and made: was it not by Number? Grammer.

But how needfull Arithmeticke is to all parts of Philosophy, they may some see, that doe reade either Aristotle, Plato, or any other Philosophers writings. For all their examples almost, and their probations, depend of Arithmeticke. It is the saying of Aristotle, that he that is ignorant of Arithmeticke, is mete for no Science. And Plato his Master wrote Philosophy.

wrote a little sentence ouer his Schoolhouse doore, Let none enter in hither (quoth he) that is ignorant of Geometry. Seeing he would haue all his Scholars expert in Geometry, much rather he would the same in Arithmeticke, without which Geometry cannot stand.

Diuinity. And how needfull Arithmeticke is to Diuinity, it appeareth, seeing so many Doctors gather so great mysteries out of number, and so much do write of it. And if I should go about to write all the commodities of Arithmeticke in ciuill acts, as in gouernance of commonweales in time of peace, and in due prouision, and order of armies, in time of warre, for numbring of the host, summing of their wages, prouisions of victuals, viewing of Artillery, with other Armour; besides the cunningest point of all, for casting of ground, for encamping of men, with such other like: And how many wayes also Arithmeticke is conducible for all priuate weales, of Lords and all possessioners, of Merchants and all other occupiers, and generally for all estates of men, besides Auditors, Treasurers, Receiuers, Stewards, Bailiffes, and such like, whose offices without Arithmeticke, are nothing: if I should (I say) particularly repeat all such commodities of the noble Science of Arithmeticke, it were enough to make a very great booke.

Armies.

Scholar. No, no sir, you shall not need: For I doubt not, but this, that you haue said, were enough

enough to perswade any man to thinke this Art to be right excellent and good, and so necessary for man, that (as I thinke now) so much as a man lacketh of it, so much he lacketh of his sense and wit.

Master. What, are you so farre changed since, by hearing these few commodities in generall? by likelyhood you would be farre changed if you knew all the particular commodities.

Scholar. I beseech you Sir, reserue those commodities that rest yet behind vnto their place more conuenient: and if ye will be so good as to vtter at this time this excellent treasure, so that I may be somewhat inriched thereby, if euer I shall be able, I will requite your paine.

Master. I am very glad of your request, and will do it spedily, sith that to learne it you be so ready.

Scholar. And I to your authority my wit do subdue, whatsoeuer you say, I take it for true. The duty of a Scholar.

Master. That is too much, and méete for no man to be beléeued in all things, without shewing of reason. Though I might of my Scholar some credence require, yet except I shew reason, I doe it not desire. But now sith you are so earnestly set this Art to attaine, best it is to omit no time, lest some other passion cole this great heate, and then Perseuerance in study.

you leaue off before you ſée the end.

Scholar. Though many there be ſo vnconſtant of minde, that flitter and turne with euerie winde, which often begin, and neuer come to the end, I am none of this ſort, as I truſt you partly know. For by my good will what I once begin, till I haue it fully ended, I would neuer blin.

Maſter. So haue I found you hitherto indéed, and I truſt you will increaſe rather then go backe. For better it were neuer to aſſay, then to ſhrinke and flie in the mid-way: But I truſt you will not ſo do, therefore tell mée briefly: What call you the Science that you deſire ſo greatly?

Scholar. Why Sir, you know.

Maſter. That maketh no matter, I would heare whether you know, and therefore I aske you. For great rebuke it were to haue ſtudied a Science, and yet cannot tell how it is named.

Scholar. Some call it Arſemetricke, and ſome Augrime.

Maſter. And what doe theſe names betoken?

Scholar. That, if it pleaſe you, of you would I learne.

Maſter. Both names are corruptly writ ten: Arſmetricke for Arithmeticke, as the Greekes call it, and Augrim for Algoriſme, as the Arabians ſound it: which both beto-

Ἀριθμητικὴ.

ken

ken the Science of Numbring: for Arithmos in Greeke is called Number; and of it commeth Arithmeticke, the Art of Numbring. So that Arithmeticke is a Science or Art teaching the manner and vse of Numbring. This Art may be wrought diuerſly, with Pen or with Counters. But I will firſt ſhew you the working with the Pen, and then the other in order. Ἀριθμός.

Scholar. This I will remember. But how many things are to be learned to attaine this Art fully?

Maſter. There are reckoned commonly ſeuen parts or works of it.

Numeration, Addition, Subſtraction, Multiplication, Diuiſion, Progreſſion, and Extraction of rots: to theſe ſome men adde Duplication, Triplation, and Mediation. But as for theſe three laſt, they are contained vnder the other ſeuen. For Duplication and Triplation are contained vnder Multiplication, as it ſhall appeare in their place: And Mediation is contained vnder Diuiſion, as I will declare in his place alſo.

Scholar. Yet then there remaine the firſt ſeuen kinds of Numbring.

Maſter. So there doth: Howbeit if I ſhall ſpeake exactly of the parts of Numbring, I muſt make but fiue of them: for Progreſſion is a compound operation of Addition, Multiplication, and Diuiſion. And ſo is the Ex-

tractions of rwts. But it is no harme to name them as kindes seuerall, seeing they appeare to haue some seuerall working. For it forceth not so much to contend for the number of them, as for the due knowledge and practising of them.

Scholar. Then you will that I shall name them as seuen kindes distinct. But now I desire you to instruct me in the vse of each of them.

Master. So I will, but it must be done in order: for you may not learne the last as soone as the first, but you must learne them in that order, as I did rehearse them, if you will learne them speedily and well.

Scholar. Euen as you please. Then to begin; Numeration is the first in order: what shall I do with it?

Master. First, you must know what the thing is, and then after learne the vse of the same.

## Numeration.

NUmeration *is that Arithmeticall* skill, whereby wee may duely value, expresse, and reade any *number* or *summe* propounded: or else in apt *figures* and *places* set downe any *number* knowne or named.

Scholar.

Scholar. Why: then me thinketh you put a difference betweene the value and the figures.

Maſter. Yea ſo do I. For the value is one thing, and the Figures are another thing: and that commeth partly by the diuerſity of Figures, but chiefly of the places wherein they be ſet.

Scholar. Then I muſt know here three things: the value, the figure, and the place.

Maſter. Euen ſo: but yet adde Order to them as the fourth. And firſt marke, that there are but ten figures that are vſed in Arithmeticke; and of thoſe ten, one doth ſignifie nothing, which is made like an o, and is priuately called a Cypher, though all the other ſometime be likewiſe named. The other nine are called ſignifying Figures, and be thus figured. A Cypher. Figures.

1. 2. 3. 4. 5. 6. 7. 8. 9.
And this is their value:
i. ij. iij iiij. v. vj. vij. viii. ix.

But here you muſt marke, that euery Figure hath two values: One alwayes certaine, that it ſignifieth properly, which it hath of his forme; and the other vncertaine, which he taketh of his place.

A place is called the ſeate or roome that a Figure ſtandeth in. And loke how many A place.

figures are written in one ſumme, ſo many places hath that whole number. And that muſt be called the firſt place that is next to the right hand, and ſo reckoning by order towards the left hand, ſo that that place is laſt that is next to the left hand. As for example: If there ſtood before you ſix men in a row, ſide by ſide, and you ſhould tell them as they ſtand in order, beginning with the man that were next to your right hand: then he that were next him ſhould be called the ſecond, and ſo forth to the furtheſt from your right hand, which is the firſt and the laſt.

Scholar. Sir, I perceiue you well: ſo might I reckon Letters or any other thing. As if I ſhould write eight letters after this order, a, b, c, d, e, f, g, h, then muſt I ſay, h, is the firſt, g, the ſecond, f, the third, e, the fourth, d, the fifth, c, the ſixth, b, the ſeuenth, a, the eighth.

Maſter. That is well done. And after the ſame ſort vſe hereafter, that what I declare by one example, do you expreſſe by another: and ſo ſhall I perceiue whether you vnderſtand it or no. And ſo paſſe ouer nothing, till you perceiue it well, and be expert therein.

Scholar. Sir, I pray you how many of theſe places be there in all?

Maſter. There is no certaine number of them, but they are ſometimes more and ſometimes fewer, according to the ſumme that is

expreſ-

expressed. For so many as the figures are, so many are the places: and the last place is so called not because it is last of all other, but it is the last of that present summe, and it may be the middle place in another summe.

Scholar. Me seemeth I perceiue this very well, as touching the order of reckoning of the places; but as for the number of them, you say there is no certainty. Now there resteth to declare the value of the figures by the diuersity of places, which you called the valuevncertaine. Value vncertaine.

Master. But first let me heare whether you know perfectly the certaine value. Value certaine.

Scholar. Yes Sir, as you wrote them, so I marked them.

Master. How write you then fiue?

Scholar. By this figure 5.

Master. And how sixe?

Scholar. Thus 6.

Master. Write these three numbers, each by it selfe, as I spake them, vii. iiii. iii.

Scholar. 7.4.3.

Master. How write you these foure other, ii.i.ix. viii?

Scholar. Thus (I trow) 2.1.6 8.

Master. Nay, there you misse; lok on mine example againe.

Scholar. Sir, true it is, I was to blame, I toke 6 for 9, but I will beware hereafter.

Master. Now then take heed, those certaine

taine values euery Figure repreſenteth when it is alone written without other Figures ioyned to him. And alſo when it is in the firſt place, though many other do follow: as for example, This figure 9, is ix. ſtanding now alone.

Scholar. How is he alone, and ſtandeth in the middle of ſo many letters?

Maſter. The letters are none of his fellowes. For if you were in France in the middle of a thouſand Frenchmen, if there were no Engliſhman with you, you would reckon your ſelfe to be alone.

Scholar. Yea it is. Then 9. without moe figures of Arithmeticke betokeneth ix. whatſoeuer other letters be about it.

Maſter. Euen ſo, and ſo doth it, if it be in the firſt place ioyned with other, how many ſoeuer do follow, as in this example, 3679. You ſée 9. in the firſt place, and doth betoken nine, as it were alone.

Scholar. I perceiue that, and doth not 7. that ſtandeth in the ſecond place, betoken vii. and 6. in the third place, betoken vi. and ſo 3. in the fourth place betoken three?

Maſter. Their figures be as you haue ſaid, but their values are not ſo. For as in the firſt place euery figure betokeneth his owne value certaine onely, ſo in the ſecond place euery figure betokeneth his owne value certaine, ten times: as in the example 7. in the ſecond

place

place is ſeuen times ten, and is, lxx. And in the third place euery figure betokeneth his owne value an hundred times, ſo the 6. in that place betokeneth vi.C. and in the fourth place euerie figure betokeneth his owne value a M. times, as in the aforeſaid number, 3. in the fourth place ſtandeth for 3. M. and in the fifth place, euery figure ſtandeth for his owne value x M times, and in the ſixth place C M times, and in the ſeuenth place a M M times, and in the eight place, x M M, ſo that euery place exceedeth the former ten times.

Scholar. As thus: if I make this number at all aduentures, 91359684, here are eight places. In the firſt place is 4. and betokeneth but foure: in the ſecond place is 8. and betokeneth ten times 8. that is 80. in the third place is 6, and betokeneth ſix hundred: in the fourth place 9 is nine thouſand: and 5. in the fifth place is x M times 5. that is fifty M. So 3. in the ſixth place is a C M times 3. that is, C C C M. Then 1. in the ſeuenth place, one M M. and 9. in the eight place, ten thouſand thouſand times 9. that is, xc M M. But now I cannot eaſily nor quickly reade it in order. A generall rule.

Maſter. That ſhall you practiſe by this meanes. Firſt, put a pricke ouer the fourth figure, and ſo ouer the ſeuenth. And (if you haue ſo many) ouer the tenth, thirteenth, ſixteenth, and ſo forth, ſtill leauing two figures betweene each two prickes. And thoſe two

roomes

Ternaries. roomes betweene the prickes are called Ternaries.

Then begin at the laſt pricke, and ſée how many figures are betweene him and the end, which cannot paſſe three, reckoning himſelfe for one: then pronounce them as if they were written alone from the reſt, and at the end of their value, ſo many times thouſands, as your numbers haue prickes.

After that come to the next three figures, and ſound them as if they were apart from the reſt, and adde to their value ſo many times thouſands, as there are prickes betweene them and the firſt place of your whole number. And ſo do by euery other three Figures following, if you haue moe. As in example, 913596841: this was your number.

Put a pricke ouer 9 in the fourth place, and ouer 1 in the ſeuenth place, and then no more (for your places come not to ten) as thus: 9 1 3 5 9 6 8 4.

Now go to the laſt prick ouer 1, and take it and the figure 9 that followeth it, and value them alone.

Scholar. 91, that is xci.

Maſter. So it is, then adde for the number of your prickes twice M.

Scholar. That is, xci. thouſand thouſand.

Maſter. So it is. Then take the three other figures from one to the next pricke, and value them.

Scholar.

Scholar. 3 5 9. that is, CCC. lix.

Master. Now adde for the one pricke, that is betweene them and the first place, 9.

Scholar. CCC. lix. thousand.

Master. Then come to the other three Figures that remaine.

Scholar. 6 8 4 that is, DC lxxxiiii.

Master. Now haue you valued all. And at the end of the last number you shall adde nothing, because there remaineth no pricke nor number after it; yet proue it in another number, as thus, 2 3 0 8 6 4 0 8 9 1 0 5 3 4 0.

Schol. 2 3 0 8 6 4 0 8 9 1 0 5 3 4 0, I haue pricked them as you taught me; but I am in doubt whether I haue done well or no, because of the Ciphers; for I remember you told me that they do signifie nothing, and therefore I doubt whether I should reckon them for a figure in setting of the pricks and againe, I know not wherefore they serue.

Master. That will I tell you now. Indeed they are of no value themselues, but they serue to make vp the number of places, and so make the figure following them to be in a further place, and therefore to signifie the more value, as in this example 90, the cypher is of no value, but yet he occupieth the first place and causeth 9 to be in the second place, and so to signifie ten times 9, that is xc. so that two ciphers thrust the figure following them into the third place, and so forth. The vse of Cyphers.

Scholar.

Scholar. Then I perceiue in the example aboue, I haue pricked well enough: for though that Cypher that is pricked signifie nothing, yet must he haue the pricke, because he came in the thirteenth place. Then will I proue to number that summe. First, there is 230, M, M, M, M, & then followeth 864, M, M, M. And what shall I now do? There is a Cypher in the third place, and no figure after him, but they that I haue reckoned.

Master. He did serue for them that you haue already reckoned, to make them in a place further then they should be, if he were away: and therefore now ye shall let him go. And so do alwayes when he occuppeth that place next before any pricke, which is the last of that Ternary, and a Cipher in the last place doth nothing.

Scholar. Then shall I say but 89. M. M.

Master. So, but go forth.

Scholar. 105. thousand. Now are all my prickes spent, and yet remaine 340. so that I must value them, CCC.xl. onely.

Master. Now can you reckon after this sort: and remember, that euery such rowme so parted, is called a Ternary or Trinity: for you haue numbred or valued the summe most truly, and by the aide of the pricks each denomination is distinct most plainly.

Trinity.

Denominations.

Scholar. What call you Denomination?

Master.

Maſter. It is the laſt value or name added to any ſumme. As when I ſay, an hundred two and twenty pounds. Pounds is the Denomination. And likewiſe in ſaying 25 men: Men is the Denomination, and ſo of other. But in this place (that I ſpake of before) the laſt number of euery Ternary is the Denomination of it. As for the firſt ternary, the Denomination is vnites, and of the ſecond Ternary, the Denomination is thouſands: And of the third Ternary, thouſand thouſands, or Millions: of the fourth, thouſand thouſand thouſands, or thouſand Millions: and ſo forth.

Scholar. And what ſhall I call the value of the three Figures that may be pronounced before the Denomination? as in ſaying: 203000000. that is, two hundred three millions. I perceiue by your words, that Millions is the Denomination: but what ſhall I call CCIII. ioyned before the millions?

Maſter. That is called the Numerator or valuer, and the whole ſumme that reſulteth of them both, is called the ſumme, value, or number. Numerator. Summe or value.

Scholar. Now is there any thing elſe to be learned in Numeration? or elſe haue I learned it fully?

Maſter. I might ſhew you here who were the firſt Inuentors of this art, & the reaſon of all

all these things that I haue taught you, but that I will reserue till ye haue learned ouer all the practise of this Art, lest I should trouble you with ouer many things at the first.

Three kinds of numbers. But yet this must you marke, that there are three kindes of numbers, one called Digits, another Articles, and the third Mixt numbers.

Digits. A Digit is any number vnder ten, as these: 1.2.3.4.5 6.7.8.9.

Articles. And 10 with all other that may be diuided into ten parts iust, and nothing remaine, are called Articles, such as are 10. 20. 30. 40. 50. &c. 100. 200. &c. 1000. &c.

Mixt. And that number is called Mixt, that containeth Articles, or at the least one Article, and a Digit, as 12. 16. 19. 21. 38. 107. 1005. and so forth: and for the more ease of vnderstanding and remembrance, marke this; The Digit number is neuer written with more than one figure, but the Article and the Mixt number are euer written with more then one figure. And thus they differ; that the Article hath euermore this Cypher 0 in the first place; and the Mixt number hath euer there some Digit.

Scholar. By these last words I perceiue it much better then I did before, and now (I thinke) I will neuer misse to know these three asunder.

Master. If you remember now all that I haue

haue said, you haue learned sufficiently this first kinde of Arithmeticke called Numeration. Howbeit I will exhort you now to remember both this that I haue said, and all that I shall say, and to exercise your selfe in the practise of it; for rules without practise, are but a light knowledge, and practise it is, that maketh men perfect and prompt in all things. Vse maketh mastery.

And as you haue learned to gather and expresse the value of a summe propounded, and set downe before you; so must you practise to marke, note, or write downe with apt Figures and in due places, any number onely named or recited to you, or of your selfe imagined, as for a proofe. How note you or write downe this summe, fiue thousand two hundred fifty and seuen?

Scholar. This troubleth me now, whether I should begin at the first or at the last. For reason (me thinketh) should cause mée to begin at the first; and yet if I write it as you speake it, I must begin at the last.

Master. When you know your places perfectly, you may begin where you list; but the more ease for your hand is to begin with the last, that is to say, as I did speake them; yet for the more surety, a while you may begin with the first, repeating my words backward thus: Seuen, fifty, two hundred, fiue thousand: or else sounding them all by their digit or value,

valewer, as thus: seuen, fiue, two, fiue: for that way is easiest: But then must you loke well whether there be any Cypher in your summe, that he may be set in his place. As if the last valewer of your summe (as you speake it) be aboue 9, then is there a Cipher in the first place. And if it be an hundred, or aboue, then is there two Cyphers, one in the first place, and another in the second, and so forth.

But because this thing is such that cannot be set forth without many words, I thinke best here now at the end of Numeration to adde a Table easie and ready for the first exercise of it.

Loe this is the Table.

The right side or hand.

The names of Digits, values certaine, or values.

| The denominators of the place or value vncertaine. | Nine. | Eight. | Seuen. | Six. | Fiue. | Foure. | Three. | Two. | One. | Cipher | The order of places. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Vnites. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | First. |
| Tennes. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Second. |
| Hundreds. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Third. |
| Thousands | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Fourth. |
| X. Thousands. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Fift. |
| C. of Thousands. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Sixt. |
| Millions. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Seuenth. |
| X. of Millions. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Eight. |
| C. of Millions. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Ninth. |
| M. of Millions. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Teoth. |
| X. M. of Millions | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Eleuenth. |

The left side or hand.

This Table (as yée may sée) hath eleuen places, and in each of them are set all the Digits, whose certaine value is written on the right hand of the Table, and the value vncertaine on the left hand, so that by this Table you may learne both how to expresse any number that you list, if that it excéd not

cleuen places) that is to say, ℔C. thousand millions, and so may you by helpe of it, value all summes proposed vnder the said number.

For example: take the summe that I proposed before, which was fiue thousand, two hundred fifty and seuen. And if you will expresse it, take the first number (as I speake it) which is fiue M. whose valuer or certaine value is 5, and his vncertaine value or denomination is M. First, you shall séeke at the right hand of the valuer 5. Then séeke along vnder the title of denomination toward the left hand till you finde thousands, and vnder it, right at the foot of the Table is the number of the place that is in the fourth, wherein you must write your digit or valuer 5.

Afterward come to the second part of the number two hundred, whose valewer is 2, and his denomination C. Séeke two at the right hand of the Table, and go along vnder the denomination toward the left hand, til you come vnder C: then looke to the foote of the Table, and there you shall sée the number of the place, that is to say, the third, wherein you must set your digit 2.

Then do so by your other two numbers that remaine, and you shall finde 5 in the second place for your fifty, and 7 in the first place for your seuen. And thus may you doe with other numbers.

Scholar. Maister, I thanke you heartily. I perceiue you séeke to instruct me most plainly

and

and briefly, and not to hide your knowledge with subtle words, as many do. For this rule is so plaine, that I can desire it no plainer. And though it seeme somewhat long, yet I perceiue it to be a sure way.

Master. So it is, and though it be long, yet it is neither too long, neither too plaine for yong learners that lacke practise: for this Table is in stead of a teacher to them that lacke one. But now I trust I haue said enough of Numeration: which after you haue well practised, then may you learne forth.

Scholar. Yet I pray you in one thing to tell me your iudgement. Why do men reckon the order of the places backward, from the right hand to the left?

Why numbers are written backward.

Master. In that thing all men do agree, that the Chaldees, which first inuented this Art, did set these figures as they set all their Letters, for they write backward, as you learne it, and so do they reade. And that may appeare in all Hebrew, Chaldee, and Arabicke books; for they be not onely written from the right hand to the left, and so must be read, but also the right end of the booke is the beginning of it, whereas the Greekes, Latines, and all nations of Europe, do write and reade from the left hand toward the right: and all their boks begin at the left side.

Scholar. That reason hath satisfied me.

Master. It neither satisfieth me, neither liketh me well, because I see that the Chaldees

and Hebrews do not so vse their owne numbers, as at another time I will declare. But this plaine reason may best satisfie you presently: that seeing in pronouncing of numbers we keepe the order of our owne reading, from the left hand to the right: and againe, we do euer name the greater numbers before the smaller: it was reason that the lesser places, containing the lesser numbers, should be set on the right hand, and the greater places containing the greater numbers, to proceed toward the left hand.

Scholar. This reason is to me so plaine, that it seemeth now against reason to make a doubt of that order. So that now for Numeration I am satisfied; hoping that practise shall make me fully ready and expert in it. And in the meane season, I desire to learne the other kindes of Arithmeticke.

Master. That is well said: but what should you next learne? can you tell?

Scholar. I remember you said that Addition was next.

Master. Euen so, and what that is, must you first know.

Addition.

# Addition.

*Addition is the gathering together and bringing of two numbers or more into one ſumme.* As if I haue 160 Bookes in the Latine tongue, and 136 in the Greeke tongue, and would know how many they be in all, I muſt write theſe two numbers one ouer another, writing the greateſt number higheſt, ſo that the firſt figure of the one being vnder the firſt figure of the other: and the ſecond vnder the ſecond, and ſo forth in order.

When you haue ſo done, draw vnder them a right line, then will they ſtand thus:

Now begin at the firſt places toward the right hand alwayes, and put together the two firſt figures of theſe two numbers, and loke what commeth of them, write vnder them, right vnder the line. As in ſaying 6, and 0 is 6 write 6 vnder 6 as thus:

| | |
|---|---|
| 160 | |
| 136 | |
| 6 | |

And then go to the ſecond figures, and doe likewiſe: as ſaying 3 and 6 is 9 write 9 vnder 6 and 3, as here you ſée.

| | |
|---|---|
| 160 | |
| 136 | |
| 96 | |

And likewiſe do you with the figures that be in the third place, ſaying, 1 and 1 be 2. write 2 vnder them, and then will your whole ſumme appeare thus:

| | |
|---|---|
| 160 | |
| 136 | |
| 296 | |

So that now you ſée, that 160, and 136, do make in all 296.

Scholar. What? this is very eaſie to do, me thinketh I can do it euen ſince.

There came through Cheapeſide two droues of cattell: in the firſt was 848 ſheepe, and in the ſecond was 186 other beaſts.

Thoſe two ſummes I muſt write as you taught me, thus: Then if I put the two firſt figures together ſaying, 6. & 8. they make 14. That muſt I write vnder 6, and 8, thus:

| | |
|---|---|
| 848 | |
| 186 | |
| 14 | |

Maſter: Not ſo, and here are you twice deceiued. First, in going about to adde together two ſummes of ſundry things, which you ought not to do, except you ſéeke onely the number of them, and care not for the things. For the ſumme that ſhould reſult of that addition, ſhould be a ſumme neither of ſheepe, nor of other beaſts, but a confuſed ſumme of both. Howbeit ſometimes ye ſhall haue ſummes of diuers denominations to be added, of which I will tell you anon: but firſt I will ſhew you where you were deceiued in another point, and that was in writing 14. which came of 6, and 8, vnder 6. 8. which is impoſſible; for how can two Figures of two places be written vnder one Figure and one place.

Scholar. Truth it is, but yet I did ſo vnder-

ſtand

ſtand you.

Maſter. I ſaid indéede, that you ſhould wꝛite that vnder them that did reſult of them both together: which ſaying is alwayes true, if that ſumme do not exceéd a digit. But if it be a mixt number, then muſt you wꝛite the digit of it vnder your Figures as you haue ſaid beforꝛe: and if it be an article, then wꝛite o vnder them, and in both ſoꝛts you ſhall kéepe the article in your mind; and therefoꝛe when you haue added your ſecond Figures, which occupy the place of tens, you ſhall put that one thereto, which you kept in your minde; foꝛ though it were ten indéed, yet in that place it is but as one, becauſe that euery one of that place is ten, foꝛ that it is the place of tens. And in like manner, if you haue in the ſecond place ſo great a number that it amounteth aboue 9, then wꝛite the digit, and reſerue the article in your minde, euer adding it to the next place following, and ſo of all other places, how many ſoeuer you haue. And if you haue a mixt number when you haue added your laſt figures, then wꝛite the digit vnder the laſt figures, and the article in the next place beyond them: ſo ſhall your number reſulting of Addition, haue one place moꝛe then the numbers which you ſhall adde together. A place.

Scholar. Now do I perceiue you, and the reaſon of this, is, (as I vnderſtand) becauſe that no one place can containe aboue 9. which is the greateſt figure that is, and then all tens

or Articles must be put to the next place following: for euery place (as I may see) exceedeth the other place next before him by 10.

Now (if it please you) I will returne to my example of cattell. But I remember you said I might not adde summes of sundrie things together, and that I may see by reason.

Master. Truth it is, if you seeke the due summe of any thing, but if you onely seeke a bare summe, and haue no respect to the thing, then were it better to name the summe onely without any thing: as in saying 848 without naming sheepe or any thing else. And likewise 186 naming nothing.

Now let mee see how can you adde those two summes?

Scholar. I must first set them so, that the two first figures stand one ouer another, and the other each one ouer his fellow of the same place: then shall I draw a line vnder them both. And so likewise of other figures, setting alwayes the greatest number highest, thus as followeth.

Then must I adde 6 to 8, which make 14, that is a mixt number, therefore must I take the Digit which is 4, and write it vnder 6 and 8. keeping the Article 1 in my minde thus:

| | |
|---|---|
| | 848 |
| | 186 |
| | 4 |

Next that, I doe come to the second figures, adding them together, saying 8 and 4 make 12, to the which I put the one reserued in my minde, and that maketh 13. of which

which number I write the digit 3 vnder 8 and 4, and kepe the Article in my minde, thus:

Then come I to the third figures, saying, 1 and 8 make 9. and 1 in my minde maketh 10. Sir, shall I write the Cypher vnder 1 and 8?

Master. Yea.

Scholar. Then of 10 I write the Cypher vnder 1 and 8, and kepe the article in my minde.

Master. What needeth that, seeing there follow no more figures?

Scholar. Sir, I had forgotten, but I will remember better hereafter. Then seeing I am come to the last figures, I must write the Cypher vnder them, and the Article in a further place after the Cypher, thus:

| |
|---|
| 848 |
| 186 |
| 34 |
| 848 |
| 186 |
| 1034 |

Master. So now you see, that of 848 and 186 added together, there amounteth 1034.

Scholar. Now I thinke I am perfect in Addition.

Master. That will I proue by this example. There are two armies of Souldiers: in the one are 106800. and in the other, 9400. How many are there in both armies say you?

Scholar. First, I set them one ouer another, beginning with the first numbers of the right hand thus:

| |
|---|
| 106800 |
| 9402 |

But the nether number will not match the ouer number.

Master.

Maſter. That forgeth not.

Scholar. Then do I adde 0. to 0. and there amounteth 0. that muſt I write vnder the firſt place thus:

| | |
|---|---|
| | 106800 |
| | 9400 |
| | 0 |

Maſter. Well ſaid.

Scholar. Then likewiſe in the ſecond place I adde 0 to 0, and there ariſeth 0, which I write vnder the ſecond place thus;

| | |
|---|---|
| | 106800 |
| | 9400 |
| | 00 |

Then I came to the third place, ſaying, 4 & 8 make 12, of which I write the digit 2, and kéep the article 1 in my mind, thus;

| | |
|---|---|
| | 106800 |
| | 9400 |
| | 200 |

Then I adde 9 to 6, which make 15, to that I adde the article 1, that was in my mind, and it is 16, I write 6 vnder 6, & 9, and kéepe one in mind thus.

| | |
|---|---|
| | 106800 |
| | 9400 |
| | 6200 |

Maſter. Why do you not write both Figures, ſéeing you are come to the laſt couple of numbers?

Scholar. Nay, reaſon ſheweth me, that I muſt adde that article that is in my minde vnto the next figure of the ouer ſumme, though there be no more in the neather ſumme.

Maſter. That is well conſidered: then do ſo.

Scholar. Then ſay I, 0 in the ouer ſumme, and 1 in my minde, maketh 1: that write I vnder

vnder 0. Then followeth there yet one more in the ouer summe, which hath none to be added to it, for there is none in the neather summe, nor yet in my mind: therefore I think I must write that euen as it is.

Master. Yea.

Scholar. Then doth my whole summe appeare thus.

| | |
|---|---|
| | 106800 |
| | 9400 |
| | 116200 |

Master. If you marke this you haue learned perfectly the common Addition of all summes which are of one denomination: so that ye obserue this also, that in Addition you must haue two numbers at the least: or else how can you say, that you do adde? And euer let the greatest number be written highest, for that is the best way, though it be not necessary.

And forget not this, that (if you haue many numbers to adde together) you shall haue oftentimes an article of a greater value then 10. sometimes 20. sometimes 30. sometimes more, yea (peraduenture) 100. Therefore as you did with the article 10. so do with them, reseruing them in your minde, and adding to the number next following so many, as their valuer or value certaine is: that is to say 2. for 20. 3 for 30. 5 for 50. 10 for 100. 12 for 120. and so forth of other like. So that, if the article be 100, then must you set downe the 0. and keepe 1 0 in minde, to be carried to the next row of figures or place, if any such happen

happen to come. For your better vnderſtanding take this example for all.

I would adde theſe thirteene ſumms into one, which I ſet after this manner: then doe I begin and gather the ſumme of the firſt row of Figures, which come to 107, (for I take 9 there tenne times, and that is 90) then 9 and 8 is 17, that is in all 107, of which ſumme I write the 7 vnder the firſt row of Figures, and then for that 100 is ten tens, I keepe ten in minde, which ten I muſt adde vnto the next row of Figures, which are in the ſecond place:

| |
|---|
| 4889 |
| 4599 |
| 2290 |
| 3699 |
| 2299 |
| 4099 |
| 1099 |
| 3298 |
| 299 |
| 699 |
| 499 |
| 899 |
| 389 |

which ſecond row of figures (when they are added together with that ten that I had in my minde) make in all 125. of which ſumme write the digit 5 vnder the ſecond row, and then (for that 120 containeth twelue tens) I keepe twelue in minde to be added to the third place or row of figures: which being added together, make in all 60 the cypher 0, I ſet downe vnder the row of figures in the third place.

And the figure 6 I keepe in minde to be added to the row of figures in the fourth place; which (when they are added together) make 29. The figure or digit 9 I ſet downe vnder the fourth place. And becauſe it is my laſt worke, I ſet downe the 2 alſo that I haue in my

my mind to the 9 in the fift place; so those summes doe make in all 29057.

¶ But (for your more ease in worke) when you haue an addition of so many summes to bée added together, you were best part that summe into two or three parts, and worke them seuerall, and so put their additions together, and this were the best things you could doe when ouer many summes fall to bée added.

| |
|---|
| 4889 |
| 4599 |
| 2290 |
| 3699 |
| 2299 |
| 4099 |
| 1099 |
| 3298 |
| 299 |
| 699 |
| 499 |
| 899 |
| 385 |
| 29057 |

Scholar. This séemeth somewhat hard by the reason of so many numbers together.

Howbeit, I thinke (if I doe often proue, euen with this same example, either by working of it alone, or else by parting it as you said euen now) that I shall be able to do so shortly with any other summe.

Master. So shall you. For it is often practise that maketh a man quicke and ripe in all things; but because, as well in great summes as in small, there may chance to be some errour, I will teach you how you shall proue whether you haue done well or no.

Scholar. That were a great help and ease.

The proofe of Addition.

Master. Begin first with the highest number, and then to all the other orderly, and adde them together, not hauing regard to their places, but as though they were all vnites:

and

and still (as your number increaseth aboue 9) cast away 9. Then go forth, euer casting away 9 as often as it amounteth thereto: and so do till you haue gone ouer all the numbers that you intended first to adde; and whatsoeuer remaineth after such addition and castings away of 9. write it in some void place by the end of a line, for the better remembrance: and thus is the first part of your worke proued. Then secondly, put together the figures that result of the addition vnder the line, still casting away 9 also. And then that that remaineth write at the other end of that line; and if those two figures be like, then haue you well done; but if they be vnlike, then haue you missed. As for example, in this present summe. The first figure of the ouer line is 9. let him go, then 8. and 8. is 16. take away 9. there resteth 7. and adde that 7. to 4. that followeth, and it maketh 11. from which if you take 9. there resteth 2. Then come to the next row, whose first and second numbers are 9. therefore ouerpasse them both, and take the 5, to the 2, which did remaine in the first row, that maketh 7. put thereto the 4. following, and that maketh 11. thence take 9, and there remaineth 2. Next vnto that, go to the third line, whose two first numbers you may let passe because they are nines: then take the two figures of 2. which (with the other two that remained, in the second row) make 6. Then go to the fourth row, whose two first numbers

numbers let go, and take the 6 to the 6, that remained, and that maketh 12: take away 9, and there resteth 3, which with the 3 that is next, maketh 6. And so go through all the other numbers, and you shall finde that there remaineth 5, after you have cast away 9, as often as you can finde it: therefore write 5 at the end of the line in a void place, thus:

5

Then gather all the figures of the totall summe, which is under the lowest line, and cast away 9, as often as you can finde it: as thus: 7, and 5 make 12, take away 9, there resteth 3, to that if you adde the 2 that is last, (for you may omit the 9) then doth it make 5, which 5 you must write at the other end of the line that you made in the void place, thus:

5 5

And then you see that those two figures be like, whereby you may know that you have done well, and so you may prove in any other.

Scholar. (If it please you) I will prove in another summe.

Master. With a good will.

Scholar. Then will I take one of your former examples, which was this.

First in the highest line 8 and 6 make 14, then 9 taken away, there remaine 5, to which I adde the 1 that followeth, & that maketh 6. Then come I to the second line, where I finde first 4,

| | |
|---|---|
| | 196800 |
| | 9400 |
| | 116200 |

which

which with 6 maketh 10, from that I take 9, and there resteth 1. the next figure is 9, and therefore I let him alone, so finde I 1 remaining which I set at the end of a line, thus.

1 ——— ———

When I come to the totall summe, and there I find that all the figures put together, make ten, from which I take nine, and there resteth 1 also, which I put at the other end of the line thus. 1 ——— ——— 1

And because they be like, I know that I haue well added.

Master. So you know now both how to adde two summes or more together, and also how to proue whether you haue done well or no; and now I will teach you how to adde summes of diuers Denominations together: which thing can neuer be but when the one Denomination is such that it containeth the other certaine times. And yet you shall adde them to the other, not after this sort (as you did them that were of one denomination) but after such a sort as I will now shew you, that is to say:

Addition of numbers of diuers denominations.

If you haue a summe of diuers denominations, then take that you set euery denomination by himselfe, with some note or figure of his denomination, as they are wont to be written. Then write your other summes so vnder that first, that euery one be set vnder the other of the same denominations: As for example, if your denominations be pounds,

pounds, shillings, and pence, write pounds vnder pounds, shillings vnder shillings, and pence vnder pence: and not shillings vnder pence, nor pence vnder pounds.

Scholar. Now that you haue spoken it, me thinketh it needeth not to warne me of it, for it were against reason so to confound sums: but yet if you had not spoken of it, peraduenture I should haue béene deceiued in it.

Maister. If you do say it is plaine, I will speake no more of it, but with an example make the matter to appeare euidently.

First one man oweth me 22 l. 6 s. 8 d. another oweth me 5 l. 16. s. 6. d. and another oweth me 4 l. 3. s. I would know what this is altogether: Therefore must I first set downe my great summe, and then the other, euery one vnder his Denomination agréeing to the greatest summe, as here you sée with a line vnder them.

| li. | s. | d. |
|---|---|---|
| 22 | 6 | 8 |
| 5 | 16 | 6 |
| 4 | 3 | 0 |

Then must I begin at the smallest numbers (which must alwaies be set next to the right) and adde them together: and (if the sum will make 1 or 2 or 3 of the next denomination) then must I kéepe it in my minde till I come to that place, and vnder that first place must I note the residue (if there remaine any of the same denomination:) but, if there remaine none, then need I to write vnder it nothing. And this is all that you must marke in this Addition: for all other things are like to the

manner of Addition before mentioned: *Therefore, the chiefest point of this Addition is, to know the values of Common Coines and rated sums.* As how many shillings be in a pound: how many pence in a shilling: of which (and of other like things) I will instruct you hereafter in teaching of Reduction. But now I may not disturbe your wit from the thing that we are about.

Therefore let vs returne to that former example which I proposed of the Debtors: which summes when I had set orderly, they stood thus with a line vnder them.

Then to adde them into one summe I must begin at the right hand where the smallest denomination is, and adde them together, first saying, 6 and 8 make 14. Now, seeing these 14 are pence, which containe one shilling and 2 pence: the 2 pence I set downe vnder the like of pence: and the one shilling I keepe in my minde to carry to the next row being the place of shillings.

| li. | s | d. |
|---|---|---|
| 22 | 6 | 8 |
| 5 | 16 | 6 |
| 4 | 3 | 0 |
| | | 2 |

Then do I adde the shillings together, saying, 1 in my minde and 3 make 4 and 6 make 10 and 6 make 16, and 1 in the second place, which standeth for 10 make 26, which is 1 pound 6 s. The 6 s. I set down vnder the place of shillings, as appeareth in the example. And the 1 pound I keepe to carry to the pounds.

| li. | s | d. |
|---|---|---|
| 22 | 6 | 8 |
| 5 | 16 | 6 |
| 4 | 3 | 0 |
| | 6 | 2 |

Then

Then come I to the pounds, adding them all together saying, 1 that I kéepe and 4 make 5 and 5 make 10 and 2 make 12. The figure or digit 2 I set downe right vnder that place or row of pounds where I gather them, and the article 1 I kéep to carry to the next place, saying, 1. in minde and 2 is 3, which 3 I set downe directly vnder the 2. And then appeareth my whole summe thus.

| li | ſ | d |
|---|---|---|
| 22 | 6 | 8 |
| 5 | 16 | 6 |
| 4 | 3 | 0 |
| 32 | 6 | 2 |

And thus must you do with any such like summes whatsoeuer, whether they be money, weight or measure, which (if you practise diuers summes) you shall be well acquainted with the feat of Addition.

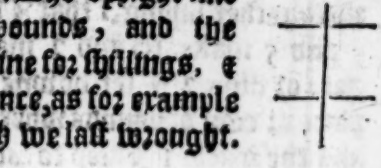
But now, can you tell how to proue this Addition, or such other like of diuers Denominations, and to try whether you haue well done or no?

Scholar. I would I could.

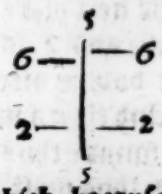
Maſter. That shall you do by this meanes: You must make a Crosse which shall haue so many lines as you haue sundry Denominations in your Addition: As if you haue but two Denominations then you may make it thus: that the ouer part and nether part may serue for one Denomination. And if you haue three Denominations (as pounds, shillings, and pence) then must you make

Proofe of Addition of diuers denominations.

thꝛee lines, thus: The vpꝛight line may ſeꝛue foꝛ pounds, and the highest thwart line foꝛ ſhillings, & the lowest foꝛ pence, as foꝛ example the ſumme which we laſt wꝛought.



| li | ſ | d |
|---|---|---|
| 22 | 6 | 8 |
| 5 | 16 | 6 |
| 4 | 3 | 0 |




Foꝛ the pꝛoſe of the which, becauſe it contayneth thꝛee denominations, I muſt make a croſſe of 3 lines as in the example beſoꝛe. Then I reckon firſt at the right hand, the pence: 6 and 8 make 14, from which I take 12 foꝛ the next Denomination, that is to ſay, a ſhilling, and there reſteth 2, which I muſt wꝛite at one end of the neather thwart line.

After that, I gather the ſumme of the ſhillings, 3. 16. 6. which maketh 25, to whom I put 1, that I toke of the pence, & that maketh 26, from thoſe I take 20. the quaptity of the next greater Denomination, that is to ſay, a pound, and there reſteth 6, which I wꝛite at the end of the highest thwart line.

Thirdly, I adde together the pounds 4. 5. and 2. which make 11. to them I adde the one that came of the ſhillings, and they make 12. from whence I caſt 9, and there reſteth 3. That 3 I ioyne to the 2 in the next place, and they make 5, which 5 I ſet at the Croſſe

alſo

also. And thus is my first part of my worke proued.

That done, I come to the totall summe vnder the line, and examine it, beginning at the pence, where I finde but 2. and cannot take 9. from him: therefore, I set him at the other end of the neather thwart line; then I come to the shillings, where I finde onely 6 which (because it is lesse then nine) I set it at the other end of the line of shillings, that is, the ouermost thwart line.

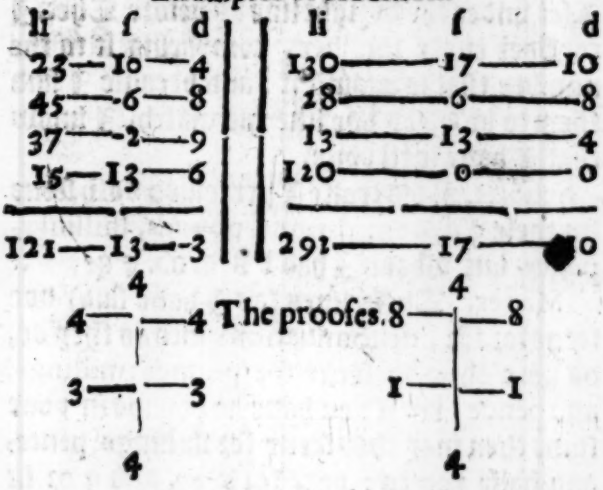
Last of all, of the 32 li. I take three times 9, which is 27, and there remaineth 5, which I write vnder the vpright line: either else I may reckon them simply without any respect of their valuation or place: saying, 2 and 3 make 5, which (because it is lesse then nine) I set vnder the vpright line as before. Then I consider euery number, comparing it to the number that is against it; and because I find them to be euery one like his match, I know that I haue well done.

Scholar. This crosse I perceiued doth serue for these 3 denominations, pounds, shillings, pence: but what if I had ℔ s. d. ob. & q?

Master. These lines (as I haue said) doe serue for three denominations, such as they be, as here three do serue for pounds, shillings, and pence: but if you haue no pounds in your sum, then may they serue for shillings, pence, and halfe pennies: yea, for d. ob. and q. or in weight for C. q. & ℔ or, in measure, for Elles,

Quarters, and Nailes, if you haue no greater Denomination: so that you remember that the vpright line serueth for the greatest Denomination, and the highest thwart line for the next, and the lowest for the least.

And so, if you haue foure Denominations, you must make your crosse with so many lines. And (if your summe be of more denominations) make so many lines in your Crosse. And thus will I make an end of Addition, sauing that here (for the better vnderstanding of this Rule) I haue set you down certaine examples both of money, weight, and measures, with their workes and proues.



Examples of Addition.

| li | s | d |
|---|---|---|
| 23 | 10 | 4 |
| 45 | 6 | 8 |
| 37 | 2 | 9 |
| 15 | 13 | 6 |
| 121 | 13 | 3 |

| li | s | d |
|---|---|---|
| 130 | 17 | 10 |
| 18 | 6 | 8 |
| 13 | 13 | 4 |
| 120 | 0 | 0 |
| 291 | 17 | 10 |

The proofes.

4 — 4 — 4

3 — 3

4

8 — 8 — 8

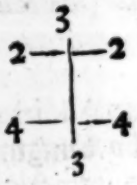
1 — 1

4

C.

| C. | q: | li |
|---|---|---|
| 24 | 1 | 3 |
| 12 | 2 | 2 |
| 7 | 3 | 4 |
| 13 | 0 | 13 |
| 57 | 2 | 22 |

| yards, | q. | nayles. |
|---|---|---|
| 17 | 3 | 3 |
| 35 | 2 | 1 |
| 26 | 1 | 3 |
| 54 | 2 | 0 |
| 134 | 1 | 3 |







## Subtraction.

# Subtraction.

## Scholar.



*Hen haue I learned the two first kinds of Arithmeticke: now (as I remember) doth follow Subtraction, whose name (me thinketh) doth sound contrarie to Addition.*

Master. So it is indeed: for, as Addition increaseth one grosse summe, by bringing many into one: so contrary wise, Subtraction diminisheth a grosse summe by withdrawing of other from it. *So that Subtraction or Rebating is nothing else but an Art to withdraw and abate one summe from another, that the remainer may appeare.*

Subtraction.

Scholar. What do you call the remainer?

Master. That you may perceiue by the name.

Scholar. So me thinketh: but yet it is good to aske the truth of all such things, lest in trusting to mine owne coniecture, I be deceiued.

Master. So it is the surest way. And (as I see cause) I will still declare things vnto you so plainly, that you shall not need to doubt. Howbeit, if I do ouer passe it sometimes (as the manner of men is to forget the small knowledge of them to whom they speake) then do you put mee in remembrance your selfe,

selfe, and that way is surest.

And, as for this word that you last asked mee, take you this discription: The remainer is a summe left after one Subtraction made, which declareth the excesse or difference of the other two numbers: as if I would abate or subtract 14 out of 18, there should remaine 4, which is called the Remainer, and is the difference betweene those two numbers 14 and 18. Remainer.

Scholar. I perceiue then what Subtraction is: Now resteth to know the order to worke it.

Master. That shall you do by this meanes. First, you must consider, that if you should go about to rebate, you must haue two sundrie summes proposed: the first, which is your grosse summe (or summe totall) and it must be set highest: and then the rebatement (or summe to be withdrawne) which must be set vnder the first, (whether it be in one parcell or in many) and that in such sort, that the first figures be one iust ouer another, and so the second, and third, and all other following as you did in Addition: then shall you draw vnder them a line, and so are your summes duely set to begin your working.

Then begin you at the right hand (as you did in Addition) and withdraw the neather number out of the higher, and if there remaine any thing, write that right vnder them beneath the line: and if there remaine nothing (by

(by reason that the two figures were equall) then write vnder them a Cypher of nought. And so doe you with all the other Figures, euermore abating the lower out of the higher, and write vnder them the Remainer still, till you come to the end. And so will there appeare vnder the line what remaineth of your grosse summe, after you haue deducted the other summe from it, as in this example.

I receiued of your Father 48 s. of which I haue laid out for you 36 s. now would I know what doth remaine? And therefore I set my number thus in order. First, I write the greatest summe, and vnder him the lesser, so that the Figures at the right side bee euen one vnder another, and so the other, thus.

| | |
|---|---|
| | 48 |
| | 36 |

Then do I rebate 6 out of 8, and there resteth two, which I write vnder them right beneath the line thus.

| | |
|---|---|
| | 48 |
| | 36 |

Then I go to the second figures, and do rebate 3 out of 4 where there remaineth 1, which I write vnder them right, and then the whole summe and operation appeareth thus:

| | |
|---|---|
| | 48 |
| | 36 |
| | 12 |

Whereby it appeareth, that if I withdraw 36 out of 48, there remaineth 12.

Scholar.

Scholar. Now will I proue in a greater summe, and I will subtract 2367924. out of 3468946 those sums I set in order thus

| | |
|---|---|
| 3468946 | |
| 2367924 | |

Then doe I begin at the right side, and deduct 4 out of 6 and there resteth 2 which I write vnder them. Then go I to the second figures, and withdraw 2 out of 4 & there remaineth 2. which I set vnder them also, then I take 9 out of 9 and there resteth 0. which I write vnder them (for you say that if the Figures be equall; so that nothing do remaine, I must write this Cypher 0 vnder them.)

Master. It was well remembred: now go forth.

Scholar. Then I come to the fourth place, and draw 7 out of 8, and there remaineth 1. which I write vnder them also: Then in the fift place I take 6 out of 6, and there resteth 0. (for if I write vnder them the Cypher 0.) Then in the first place 3 rebated from 4, there remaineth 1. which I write vnder them, and likewise in the seuenth and the last place 2 taken from 3. there is left 1.

Which I write vnder them: so haue I done my whole worke, and my summes do appeare thus. Whereby I see, that (if I do rebate 2367924 out of 3468946) there remaineth 1101022.

| | |
|---|---|
| 3468946 | |
| 2367924 | |
| 1101022 | |

Master. This is well done. And that you may be sure to perceiue fully the Art of Subtraction,

traction, let mée sée how you can subtract 52984732. out of 8250003456.

Scholar. First, I set downe the greatest summe, and after that, I write vnder it the lesser number, beginning at the right side, and then my figures will stand thus.

8250003456
52984732

Then take I 2 from 6, and the rest is 4. which I writs vnder them. Then do I withdraw 3 from 5, and there remaines 2. which I write vnder them. Then take I 7 out of 4, but that I cannot, what shall I now do?

Note. Master. Marke well what I shall tell you now, how you shall do in this case, and in all other the like: if any figure of the neather summe be greater then the figure of the summe that is ouer him (so that it cannot be taken out of the figure ouer him) then must you put 10 to the ouer figure, and then consider how much it is, and out of that whole summe withdraw the neather figure, and writs the rest vnder them. Can you remember this?

Scholar. Yes, that I trust I shall. Now then in mine example where I should haue taken 7 out of 4. and could not, I put 10 to that 4 which maketh 14. from it I take away 7. and there resteth 7 also, which I write vnder them.

Master. So haue you done well, but now must you marke another thing also: that (when

(whensoeuer you do so put ten to any figure of the ouer number) you must adde one still to the figure or place that followeth next in the neather line: as in this example there followeth 4, to which you must put 1, and make him 5. and then goe on as I haue taught you.

| | |
|---|---|
| 825000345 6 | |
| 52984732 | |
| 018732 | |

Scholar. Then shall I say, 4 and 1 (which I must put to him for the 10 that I added to 4 before) make 5, which I should take out of 3, but that cannot be: therefore I must put to it also 10, and then it will be 13, from which I take 5, and there resteth 8 to be written vnder them: and because of that 10 added to the 3. I must adde one to 8 that followeth in the neather line, and that maketh 9. which I should take out of 0 and cannot: therfore I put there to 10, & that maketh 10, from 10 I take 9, and there remaines 1, which I write vnder them.

Thus do I adde 1 likewise to the next figure beneath, which is 9, and that maketh 10, that 10 should I take out of the figure aboue, but I cannot: for it is 0 therefore I put 10 to it, and so take I 10 out of 10, and there resteth 0 to be written vnder them.

Then come I to the next figure, which is 2, and to him I do adde 1 which maketh 3: that 3 I cannot take out of nought: therefore of that nought I make 10, and thence do take 3, so there remaineth 7 to be written vnder them: likewise do I put 1 to 5, that

that 5, and make it 15. from which I rebate 6, and there remaineth 9, which I write vnder them. Now haue I spent all the neather figures, and what shall I doe more.

| | |
|---|---|
| 8250003456 | |
| 5298473 2 | |
| 8197018724 | |

Master. You should haue added one to the next figure following (if there had beene any) because you added 10 to the last figure before of the ouer line: but seeing there is no figure following, you must adde that one to the place following, and then deduct that one from the number aboue.

Scholar. Then shall I say, because I borrowed 10 to the ouer 5, I must put 1 in the next place beneath, that is vnder 2, then must I subtract that 1 from 2, and there resteth 1, to be written vnder that in the ninth place. Now I haue no more to subtract, for there is not any figure remaining beneath, neither yet any Vnite to be added, because I borrowed not 10 to the figure last before: and yet is there 8 remaining in the ouer line, which I thinke (by reason) should be set at the end of the figures in the lowest row, which is vnder the line, for because there was nothing taken from it.

Master. That is well considered, and reason teacheth so indeed.

Scholar. But Sir, I beseech you, shall I alwayes when any number so remaineth alone, as this 8 did, write him vnder the line straight

straight against his owne place?

Master. Yea, what else? Whether they be one or many: and this well remembred, you haue sufficiently learned Subtraction: Howbeit, because of certaine things that might deceiue you, if you did not take good héed to your working, I will propose to you another example of many numbers to be subtracted. as thus. I receiued of a friend of mine to kéepe 2869 crownes, of which at one time I deliuered him againe 500. at another time 368. at another time 440. at another time 80 and another time 64 now would I know how many do rest behinde? Therefore first I set downe my grosse summe and vnderneath it I set all the parcels thus, and vnder them a double line.

2869 *Crowns receiued*

500
368
440
80
64
} *Deliuered.*

Then first I begin at the first place, and gather together the summe of all those lines (saue the ouermost) in their first figures: and so I do with all the figures of the second place, and so forth, as I did in Addition, saue that I leaue out the highest row of numbers (as the line warneth mée) and that summe so gathered betwéene the double line, is the summe deliuered in all: which summe I do afterwards subtract out of the highest row of numbers, and the remainer do I set vnder the neathermost line: as

Note.

as for example.

I set the summes as before: then do I gather the first figures of all the places delivered, together: where I find but 4, and 8, that maketh 12. (for three Cyphers increase no summe in Addition, as you learned before:) of the 12 therefore, do I write the Digit 2. betweene the double line, and keepe the Article in my minde, till I come to the second place, where I finde 6. 8. 4. 6. that maketh 24. to them I put the Article in my minde, and it is 25. of which I write 5. under the second place, and keep the Digit 2 in my mind for the third place, where I finde 4. 3. 5, that makes 12. to the which I adde the 2 in my minde, and it maketh 14, thereof I write the 4 under the third place, & because there remains no moe figures to be added, I write the Digit in the fourth place, as you see in the example: and so it appeareth, I have delivered in all, a thousand foure hundred fifty two crownes.

| | |
|---|---|
| 2869 | *Crowns received.* |
| 500 | |
| 368 | |
| 440 | *Delivered.* |
| 80 | |
| 64 | |
| 1452 | *Delivered in all* |
| 1417 | *Rest behinde.* |

Then come I to the subtracting of this summe betweene the lines, for by Addition it is equall to the five parcels over it. Therefore I proceed to subtract it from the overmost summe, saying, 2 from 9 remaine 7, to be written under them beneath the lowest line.

line. Then in the second place I take 5 from 6, and there resteth 1 to be written vnder them. Then in the third place, 4 from 8, resteth 4 Last of all, in the fourth place. 1 from 2, remaineth 1. And thus I see that after those fiue sommes are subtracted from 2869 the Remainer is 1417.

Scholar. This I perceiue: but is there no shorter way and more speedy?

Master. Yea, when you are a while exercised in it: for you may (as fast as you can gather the numbers together) withdraw them out of the highest summe. But if in quantity those numbers added together, excede the highest summe or vpper number, then shall you (as before hath beene taught you) imagin to borrow 10, 20, or 30 more, as nede shall require, and put them to the vpper number, to helpe to further the abatement, reserving or restoring the Articles that you borrowed to the next place againe: & so still go forward till you haue ended your worke: as for example. In the last summe proposed. I gather first in the first place 4 and 8 that maketh 12, which 12 I should deduct or take out of 9 in the vpper number aboue the line, but I cannot: that therefore I ad vnto 9 an article of 10 & maketh the vpper number 19 from whence I take 12, then there resteth 7; then for the Article 10 I adde to the next place of mony deliuered; saying, I that I bring and 6 make 7, & 8 make 15, & 4 make 19 and 6 make 25.

An abridgment of the former manner of Substraction.

which 25 I should take out of 6 in the vpper number, but I cannot. Therefore I adde 2 tens or 20 vnto 6 in the vpper number, and that maketh 26, then 25 out of 26, resteth 1; then the tens which I borrowed, or haue in mind, I adde to the nert row or sum deliuered; saying, 2 that I bring, and 4 make 6, and 3, make 9, and 5 make 14; then 14 out of 8 I cannot take, but 14 out of 18 resteth 4. Now because there are no more places to bee added, the one that I borrowed, or haue in mind, I rebate from 2 in the vpper line, and there remaineth 1, which I set downe in the remainer line; and so my summe appeareth (as before) to be 14 17 Crownes.

Loe thus haue you now a shorter way.

Scholar. I like both waies well, and I perceiue both well: yet, as in the working seemeth somewhat long, so in the other it leaueth very much (me seemeth) to remembrance, and therefore may cause errour quickly, except a man haue a quick and an exercised remembrance. But yet for the sharpning of my wit by your patience (if you will giue me leaue) I will try what I can doe in a like summe, to worke it the shortest way: whereupon I would subtract out of 40301964. these three parcels.

Therefore

Therefore I set them first in due order: then I gather the parcels of the first place, which are 8. 2. 1. that is a 11, which I should take or deduct out of 4, which is ouer him, but I cannot: therefore I adde an article or one ten to 4, which maketh 14. then 11 out of 14. there resteth 3 to be written vnder the first place betweene the two lines.

| | |
|---|---|
| 40301964 | *Charge.* |
| 20003428 | *Disch.* |
| 10002432 | |
| 10101461 | |
| 43 | |

Then come I to the second place, saying, 1 that I borrowed to haue in my mind, & 6 make 7, & 3 make 10, and 2 make 12, which I cannot take from 6, therefore I adde 10 to 6, which maketh 16, & then 12 from 16 resteth 4, which I write vnder the second place betweene the two lines.

Then come I to the third place, saying, I that I borrowed or haue in mind and 4 make 5, and 4 is 9, and 4 make 13, which I should take out of 9 that is ouer them, but I cannot: therefore I adde 10 to 9 which make 19, then 13 out of 19, rest 6.

Then come I to the fourth place, saying, 1, in minde and 1 is 2, and 2 is 4, and 3 make 7, which because it cannot bee taken from 1, I take it from 11, and there resteth 4.

After that, I come to the fift place, where are onely three Ciphers, which make nothing,

vnto which I adde 1 in minde, then should I take that (that is to say) 1 from the figure ouer them, which is also a Cipher: therefore I say thus, I cannot take 1 from 0, but 1 from 10 remaineth 9: so must I write 9 vnder them. Then in the first place I finde but 1, and 1 in minde make 2, which I take out of 3 ouer him, and the remainer is 1: that must be written betweene the two lines in the firth place. So I go to the seuenth place, where I find onely Ciphers, & in the grosse summe ouer them a Cipher also: therefore must I write the remainer (which is nothing) with a Cypher also. Then in the eight & last place, I gather 1, 1, 2, that maketh 4, which if I take out of that 4 that is ouer them, there will nothing remaine. And that must be noted with a Cipher betweene the two lines (as I haue often said) and so haue I ended my worke, and the figures stand as followeth.

But Sir, I remember you taught mée that Cyphers should not come in the last place, for because they serue onely to increase the value of other figures which follow them, and serue not those figures that go before them: and now in my Example I haue set two Cyphers in the two last places.

Master. I commend you for your remembrance. And truth it is, you should not haue set them here, but onely because that I would make you plainly to perceiue the art of Subtraction,

traction. Therefore seeing that you do now perceiue it, whensoeuer you would write downe a Cypher, loke whether any other figures be yet behinde: and if not, then let go the o also, for it needeth not to write him in the latter places, where no other figure doth follow, except it be (as I did now suffer you) to teach the vse of Subtraction the plainer.

Therefore your figures must stand thus when the worke is ended.

| | |
|---|---|
| 40301964 | *Charge.* |
| 20003428 | *Disch.* |
| 10002432 | |
| 10101461 | |
| 194643 | *Rest.* |

Scholar Sir, I do thinke with that that you taught me before, and by these two summes that you taught me last also, that now I could subtract any summe.

Master. So may you, if you haue marked what I haue taught you. But, because this thing (as all other) must be learned surely by often practise, I will propound here two examples to you: wherein if you often exercise your selfe, you shall be ripe and perfect to subtract any other summe lightly, for in them is contained all the obseruances of whole numbers. And because you shall perceiue somewhat both how to do it, and also whether it be well done when you haue proued to do it; therefore haue I written vnder them both, the Remainers.

| | | | |
|---|---|---|---|
| 30606. | *Lent.* | 308964. | *Debt.* |
| 10354 | *Paid.* | 103145 | *Paide.* |
| 10249 | | 102597 | |
| 163 | | 101024 | |
| 20766 | *Paid in all.* | 02198 | *Rest.* |
| 9840 | *Rest to pay.* | | |

Scholar. Sir, I thanke you: but I thinke I might the better do it, if you did shew mee the working of it.

Master. Yea, but you must proue your selfe to do some things without my aid, or else you shall not be able to do any more then you are taught: And that were rather to learne by wrote (as they call it) then by reason. And againe, there is nothing in these examples, or any other of whole numbers, but I haue taught you the rules of them already.

Scholar. Then I trust by practise to attaine the vse of it. And is this all that I shall learne of Subtraction?

Master. Yea, sauing that (as you haue seene in Addition) there are numbers of diuers Denominations, in which the working is not much vnlike: yet (without some instructions be giuen of it) it might seeme to a learner more difficult then indeed it is. Therefore I will briefly shew you the vse of it onely by an example or two.

*A certaine man owed to me:* 14 l, 12 ſ, 8 d,
*of which he paid me at one time* 4 l, 6 ſ, 8 d,
*at another time* 3 l, *at another* 2 l, 3 ſ, 4 d,
*and laſt of all* 6 ſ, 8 d.

Now would I know what remaineth vnpaid yet: therefore I ſet my ſummes thus, euery one in their due place: As pounds vnder pounds, ſhillings vnder ſhillings, pence vnder pence

| li | ſ | d |
|---|---|---|
| 14 | 12 | 8 |
| 4 | 6 | 8 |
| 3 | 0 | 0 |
| 2 | 3 | 4 |
| | 6 | 8 |

Scholar. Sir, I pray you why doe you write 2 l for the common ſpeech vſeth rather to ſay, 40 s.

Maſter. We muſt here vſe the Denomination that is greateſt in any ſumme, ſo that wee may not write according as wee vſe to ſpeake, ſaying, 16 d, 18 d, or likewiſe 7 groats, 8 groats, 24 s, 40 s, 48 s and ſuch other: but we muſt write euery Denomination that is in any ſumme by it ſelfe. Note how the penne differeth from the common order of Counters

Namely, ſhillings and pounds. So muſt wee write for the laſt ſummes now named, 1 s, 4 d; 1 s; 6 d; 2 s, 4 d; 2 s, 8 d; 1 l, 4 s; 2 l, 8 s, and ſo forth of other like.

Scholar. So that we may not write in Arithmeticke, pence, when the ſumme amounteth to ſhillings, nor ſhillings, when the ſumme maketh pounds. Now, (if it pleaſe you) end your example.

Maister. When my summes are so set as I shewed, then (according to the rules of Addition) I gather all the particular summes which bee paid mee into one totall summe, directly to bee set vnder them betweene the two lines, not medling with the 14 l. 12 s. 8 d. as the line warneth mee: therefore must I begin with the smallest Denomination, saying, 8, 4, 8, is 20, pence, which maketh one shilling and 8 pence, the 8 d I set downe vnder the place of pence, and the one shilling I keepe in mind to carry to the next denomination of shillings. Then come I to the shillings, and say, one that I bring or haue in minde, and 6 is 7, and 3 is 10 and 6 makes 16, which, because it containeth not one pound, I set directly vnder the place of shillings. Then come I to the pounds, whose parcels are 2, 3, 4, that is in all 9, that 9 doe I set downe directly vnder the pounds: And so the totall or whole Addition of all the particulars paid, amounteth to 9 l. 16 s. 8 d.

| li | s | d | |
|---|---|---|---|
| 14 | 12 | 8 | |
| 4 | 6 | 8 | } |
| 3 | 0 | 0 | } |
| 2 | 3 | 4 | } |
| | 6 | 8 | } |
| 9 | 16 | 8 | |
| 4 | 16 | 0 | *Rest.* |

Now, for the worke of Subtraction, I must rebate that totall summe of Addition out of the highest number, that is to say, from the

the 14.l. 12 s. 8 d.

Therefore to performe the worke, I say, 8 d. out of 8 d. remaineth or resteth nothing. therefore in the place of the rest or remaine, right vnder the denomination, I set downe 0. Then comming to the shillings, where I find 16, which should bee taken out of 12, but I cannot: therefore I imagine to borrow 1 of the next Denomination, that is, of the 14 l, and put that one pound so borrowed vnto 12 s, that maketh 32 s.

Now 16 s, out of 32 s resteth 16 s, which 16 s I set downe directly vnder the place of the rest.

Lastly, comming to the pounds, saying, one pound in mind that I borrowed, and 9 make 10, then 10 out of 14, there resteth 4. So doth my whole rest or remaine, appeare to be 4 l. 16 s. 0 d.

This I account the easiest way for a young beginner to practise, though it be something long.

Scholar. Is there any shorter way for this worke also?

Master. Yes, as in this last example I will also shew you, for you may adde together the particular summes as

they

they are set in order, beginning with the pence, saying, 8, 4 8, make 20 d. which 20 d. you should take out of the 8 d. above the line, but you cannot, therefore shall you borrow 1 of the next denomination, that is to say 1 of the shillings, & put it to the 8 d. that maketh 20 d, now 20, out of 20 d resteth 0, which Cypher I set down directly under them.

| li | s | d |
|---|---|---|
| 14 | 12 | 8 |
| 4 | 6 | 8 |
| 3 | 0 | 0 |
| 2 | 3 | 4 |
| 0 | 6 | 8 |
| 4 | 16 | 0 |

Then one shilling that I borrowed or had in mind, and 6 make 7. and 3 make 10, and 6 make 16 the 16 out of 12 I cannot take, therefore of the next Denomination I doe borrow one l, and put it to 12 s. which maketh 32 s, then 16 s, out of 32 s resteth 16 s.

Lastly, I came to the pounds, saying, 1 l in minde, or that I borrowed, and 2 make 3. and 3 is 6 and 4 is 10, then 10 out of 14 there resteth 4.

So doth my remainer or rest appeare as before to be 4 l, 16 s, 0 d.

Scholar. This doe I perceiue very well, and if there bee no other things to be learned in Subtraction, then may I come to Multiplication, for that you reckoned to be next in order.

Mast. We haue done indeed with the Art of Subtraction, as touching the working.

But yet before we goe to Multiplication, I will

will instruct you how to examine your worke, whether it be well done or not. For the performance whereof, if you marke what I said in Addition, you may easily perceiue what is to be done for the proofe of Subtraction, which is best made by the aides of Addition thus. Proofe of Subtraction.

Draw vnder the lowest number (which is your Remainer) a line, and then adde this Remainer and all the other that you did substract before, together, and write that that amounteth vnder the lower line: and if the summe that commeth thereof, be equall to the highest of the Substraction, then is the Substraction well wrought, or else not. As you may see for example in the summes set downe before, and first in summes of one Denomination, whereof one was this.

Where the number 52984732 is substracted from 8250003456. & the Remainer is 8197018724

| | |
|---|---|
| 8250003456 | |
| 52984732 | |
| 8197018724 | |

Now to proue whether it be truly wrought or not. I adde the Remainer and the number substracted, together, beginning at the right hand; and first I say 4 and 2 is 6 which is set vnder the line. Example in a sum of one denomination.

| | |
|---|---|
| *The number giuen* | 8250003456 |
| *The number to Substract* | 52984732 |
| *The remainer* | 8197018724 |
| *The Proofe.* | 1250003456 |

Then againe in the second place I say 2 and 3 is 5, which I write vnder, next that in the third

third place, 7 and 7 are 14, of which I write the Digit 4, and kéepe the Article 1 in my minde. Then in the fourth place 8 and 4 is 12 and 1 in my minde maketh 13. whereof I write downe the Digit 3, and kéepe the Article 1 in my mind. Againe in the fift place, 1 and 8 is 9, and 1 in my minde is 10. Whereof I set downe 0 and kéepe the 1 in my minde. And so going on to the reſt (as it is taught in Addition) when I haue made an end, I ſée that the loweſt line of numbers & the higheſt be a like: wherefore I know that I haue well done.

So likewiſe the proofe is to bée made in numbers of diuerſe Denominations: as for example in our ſumme of that kinde which in the firſt forme of working, ſtood thus; (all the particular numbers to bée ſubtracted, being drawne into one.)

Example in a ſum of diuers denominations.

Where, in the title of pence, I find 8 and 0; the 8 I ſet downe directly vnder in that of pence.

Then in the place of ſhillings I find 16 and 16 which make 32 ſhillings, wherein is contained 1 ℔ and 12 ſ. the 12 ſ, I ſet downe directly vnder them in the one place

| | li | ſ | d |
|---|---|---|---|
| | 14 | 12 | 8 |
| | 4 | 6 | 8 |
| | 3 | 0 | 4 |
| | 2 | 3 | 0 |
| | | 6 | 8 |
| *Paid in all* | 9 | 16 | 8 |
| *Reſt.* | 4 | 16 | 0 |
| *Proofe.* | 14 | 12 | 8 |

of

of ſhillings, and one pound I kéepe.

Then comming to the pounds, I ſay, 1 that I kéepe, and 4 is 5, and 9 is 14, which 14 in due order I ſet downe directly vnder them as this figure ſheweth. And the whole ſumme is 14 l, 12 s, 8 d. agréeing with the vpper number aboue. So I finde the worke is good, and the Subtraction well wrought.

The ſame thing is to be done for the latter forme of Subtraction (where the particular ſummes are not gathered together into one groſſe.) For the Remainer and all the particular ſummes ſubtracted, being added together, if the ſumme that commeth thereof bée equall to the higheſt number aboue, then is the Subtraction well wrought, or elſe not.

As for example alſo in the laſt ſums which ſtood thus.

| li | s | d |
|---|---|---|
| 14 | 12 | 8 |

Example of aproofe in the latter forme of Subtraction.

Firſt, in the title of pence, I adde 8, 4, 8, that maketh 20 d, which containeth one ſhilling and 8 pence.

| | | |
|---|---|---|
| 4 | 6 | 8 |
| 3 | 0 | 0 |
| 2 | 3 | 4 |
| 0 | 6 | 8 |

The 8 I ſet down vnder the loweſt line in the row of title of pence, and that one ſhilling I kéepe to carry the next Denomination or place of ſhillings.

| | | |
|---|---|---|
| 4 | 16 | 0 |
| 14 | 12 | 8 |

Then returning to the ſhillings, ſaying:

ons

one in minde, or that I keepe, and 16 make 17, and 6 make 23, and 3 make 26, and 6 make 32 shillings, which amounteth to one pound, 12 s, the 12 s I set downe vnder the title of shillings, and 1 pound I keepe or haue in minde to carry to the next Denomination or place of pounds. Then come I to the pounds, saying, 1 that I bring and 4 make 5, and 2 make 7, and 3 is 10, and 4 make 14, then do I write 14 vnder the pounds, and so haue I ended the Addition: and I see that the lowest line is like vnto the vppermost line in number, wherefore I know that I haue well done.

And thus haue I taught you the Art of Subtraction, and the meanes to proue whether it be well wrought or not. Therefore now will I make an end thereof, and will instruct you in Multiplication.

Multipli-

# Multiplication.

*Multiplication is an operation whereby two ſummes produce the third: which third ſumme ſo many times ſhall containe the firſt, as there are Unites in the ſecond. And it ſerueth in ſteade of many Additions.* As for example: When I would know how many are 30 times 48. if I ſhould adde 48 thirty times, it would bee a long worke. Therefore was this worke of Multiplication deuiſed, which ſhall doe that at once that Addition ſhould do at many times. Multiplication what it is

Scholar. I perceiue the commodity of it partly, but I ſhall not ſee the full profit of it till I know the whole vſe of it. Therefore Sir, I beſeech you, teach mee the working of it.

Maſter. So I iudge it beſt, but becauſe that great ſummes cannot be multiplied, but by the Multiplication of Digits, therefore I thinke it beſt to ſhew you the way of multiplying them As when I ſay, 9 times 8 or 8 times 9 &c. And as for the ſmall Digits, vnder 5 it were but folly to teach any rule, ſeeing they are ſo eaſie that euery childe can doe it: but for the Multiplication of the greater Digits, thus ſhall you doe. Multiplication of Digit.

Firſt, let your Digits one right ouer the other,

other then from the vppermoſt downeward, and from the nethermoſt vpward; draw ſtraight lines, ſo that they make a croſſe, commonly called Saint Andrewes croſſe, as you ſée here. Then looke how many each of them lacketh of 10, and write that againſt each of them at the end of the lines, and that is called the difference: as if I would know how many are 7 times 8, I muſt write thoſe Digits thus.

The difference.

*Digit difference*

8
7

Then doe I looke how much 8 doth differ, from 10 and I find it to be 2: that 2 doe I write at the right hand of 8, at the end of the line thus.

*Digit difference*

8 2
7

After that I take the difference of 7 likewiſe from 10, that is 3, and I write that at the right ſide of 7, as you ſée in this example.

*Digit difference*

8 2
7 3

Then do I draw a line vnder them, as in Additi-on thus

Laſt of all, I multiply the two difference, ſaying 2 times 3 make 6, that muſt I euer ſet vnder the differences, beneath the line: then muſt I take one of the differences (which I will, for all is like) from the other digit (not from his owne) as the lines of the Croſſe warne

warne me, and that that is left, must I write vnder the digits. As in this example, if I take 2 from 7, or 3 from 8, there remaineth 5: that 5 must I write vnder the digits, and then there appeareth the multiplication of 7 times 8 to be 56. And so likewise of any other digits, if they be aboue 5, for if they be vnder 5, then will their differences be greater then themselues, so that they cannot bee taken out of them. And againe, such little summes euery childe can multiply, as to say, 2 times 2, or 4 times 5, and such like.

*Digit difference.*

8 2

7 3

5 6

Scholar. Truth it is. And seeing mee seemeth that I vnderstand the multiplying of the greater digits, I will proue by an example how I can do it. I would know how many are 9 times 6.

Master. It is all one in value to say 9 times 6, or 6 times 9: but yet the order is best to put the lesse summe first, saying, 6 times 9, and so of all other summes.

Scholar. Then would I know how many are 6 times 9: therefore I set the digits thus, and make the crosse, thus.

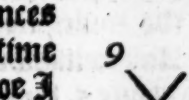
9

6

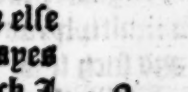
Then doe I set their differences from 10 at the right side, the difference of 9, which is 1, against it, and the difference of 6 which is 4, against it also, as in this example.




And vnder them draw a line, Then doe I multiply the differences together, saying: 1 time 4 maketh 4, that 4 doe I write vnder them thus.




Then take I one of the differences from the other digit, as, 1 from 6, or else 4 from 9, and each wayes there resteth 5, which I doe write vnder the digits thus. And so appeareth the multiplicatiō of 6 times 9 to be 54 Thus I see the feat of this manner of multiplication of digits.




Master. Now might you go straight to the multiplication of great numbers, saue that both for your ease and surety in working I will draw you here a Table, whereby shall appeare the multiplication of all the Digits, and this is it that followeth.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| | | 3 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| | | | 4 | 16 | 20 | 24 | 28 | 32 | 36 |
| | | | | 5 | 25 | 30 | 35 | 40 | 45 |
| | | | | | 6 | 36 | 42 | 48 | 54 |
| | | | | | | 7 | 49 | 56 | 63 |
| | | | | | | | 8 | 64 | 72 |
| | | | | | | | | 9 | 81 |

*In which Table when you would know the product in any multiplication of Digits, seeke your first or last Digit in the greater figures, and from it go right forth toward the right hand, till you come vnder the number of your second Digit, which is in the highest row, and then the number that is in the meeting of the rows of little squares (which come directly from both your prepounded Digits) is the Multiplication that amounteth of them.* As if I would know by this table the multiplication of 7 times 9, seeke first 7 in the greater figures, and then go right forth toward the right hand, till you come vnder 9 of the highest row, in which place where you so come vnder the other digit (as here for example you come vnder 9) is alwayes contained the of come or product, which you seeke,

and that place we terme to be in the common angle, in respect of the two numbers so taken on the outsides: as here in that common angle, where the rows of little squares directly proceeding from 7 and 9 do meet, you have 63, which 63 is the summe of the multiplication of 9 by 7.

To multiply greater sums.

Scholar. This is very good and ready. And so may I find the multiplication of any digits: but now how shall I do in greater summes?

Master. *When you would multiply any summe by another, you shall marke that it is the meetest order to set the greatest number highest, which is the place of the number that must be multiplied: and likewise the lesser number vnder it, for that*

Multiplier. *is the place of the Multiplier or Multiplicator, that is to say, the number by which the Multiplication is made, and is in English alwayes put before this word, Times: in such speaking when*

Times. *I say, 20 times 70. And the number that followeth this word Times, is that which must bee multiplied.*

Therefore when I would multiply one number by another, I must write the greatest highest, and the lesser vnder it, as in Addition. And vnder them must I draw a line. As for example. If I would multiply 264 by 29, I must set them thus.

| | |
|---|---|
| 264 | |
| 29 | |

¶. Of which numbers thus set downe to be multiplied, may be formed a question, as thus. There are 29 men, and each man hath

264

264 Lambes. The queſtion is, how many Lambes they haue in all.

To the perfoꝛmance whereof, I muſt multiply euery figure of the higher roꝛw, by euery figure of the neather roꝛw: and that that amounteth I muſt ſet vnder the line, as thus.

First I doe multiply 4 by 9, ſaying: 9 times 4 (oꝛ 4 times 9 which is all one) and that maketh 36, as the Table beſoꝛe of digits doth declare, of that 36 I muſt wꝛite the 6, that is the Digit, vnder the 9, and the Article 3 I kéepe in minde to carry to the next place.

| | |
|---|---|
| 264 | |
| 29 | |
| | 6 |

Then come I to the ſecond figure of the higher roꝛw, which is 6, and ſay: 9 times 6 make 54, and with the 3 in my mind, make 57. the 7 I ſet doꝛwne vnder the 2, and 5 I kéepe in minde.

| | |
|---|---|
| 264 | |
| 29 | |
| | 76 |

After that I come to the next figure, which is 2, and multiply it by 9, and that maketh 18, and with 5 that I haue in minde, maketh 23: wheꝛeꝛoꝛe becauſe it is the laſt woꝛke of the Muliplier, I ſet it doꝛwne in oꝛder as you ſée:

| | |
|---|---|
| 264 | |
| 29 | |
| 2376 | |

And ſo haue I ended the firſt figure of the Multiplier. Wheꝛeꝛoꝛe I giue it now a fine daſh with my pen.

Then begin I with the next figure, and multiply it into all the higher figures, as thus:

```
264
 29
2376
```

First, 2 times 4 make 8, that 8 do I write vnder the second place: for euermore the Digit or first figure of the Multiplication that amounteth of the figure of the higher number, must be set vnder the Multiplier of it, the other in their order toward the left hand.

Scholar. I vnderstand you thus, that the Digit of the summe amounting of the Multiplication of the first figure of the higher row, by the first figure of the lower row, or Multiplier, must be set vnder the first place: and that that amounteth of the same first figure by the second Multiplier; must be set vnder the second place, and so of the other, if there be more Multipliers.

Master. So meane I indeed: and if there amount but a Digit, then must it be set vnder the Multiplier.

And now to go forth: I multiply by the same 2, the second figure of the higher row, which is 6, saying, two times 6, make 12, whereof I write the digit 2 vnder the third place, and the Article 1 I keepe in minde.

```
264
 29
2376
  28
```

Then do I multiply the last figure of the higher summe by that same 2, saying, two times 2 is 4, and with the 1 that I haue in minde maketh 5, which 5 I write vnder the fourth place. And so

so haue I ended the whole Multiplication: wherefore I also giue the 2 a dash with my pen, thus: and so I doe euer as sone as I haue dispatched any Digit by which I multiply: and the summes stand thus.

| | |
|---|---|
| | 264 |
| | 29 |
| | 2376 |
| | 528 |

Then must I drawe a line vnder all those summes that mount of the multiplication, and must adde all them into one summe, as in the example you may see.

| | |
|---|---|
| | 264 |
| | 29 |
| | 2376 |
| | 528 |
| | 7656 |

Where in the first place I finde but 6, and therefore write I it vnder the line. Then in the second place 8 and 7 make 15, whereof I write 5, and keepe one in my minde, and so forth as you learned in Addition. And so appeareth the whole summe to be 7656, which amounteth of the Multiplication of 264, by 29 and that is the iust number of the Lambes the 29 men had.

Scholar. If there be no more to be obserued in it, then can I do it, I suppose, as by this example I shall proue.

¶ There is a peece of ground which containeth 1365 yards in length, and 236 yards in breadth: I would know how many yards square there is in all this peece of ground: which numbers I set downe with the greater aboue, and the lesser vnder, as you see

| | |
|---|---|
| | 1365 |
| | 236 |

Then doe I multiply 5 by 6, saying, 6 times 5 make 30, of which I write the Cipher in the first place and the Article 3 I doe kæpe in minde to carry to the next place.

1365
236
-0

Then doe I by the same 6 multiply the second figure of the higher summe, which is 6, saying, 6 times 6 make 36, and 3 in my minde make 39, of which I write the 9 under the second place and the Article 3 I kæpe in minde.

1365
236
90

Then do I multiply the third figure, which is 3 by the same 6, and that maketh 18, and 3 in my minde make 21. The 1 I set downe, and kæpe 2 in minde.

1365
236
190

Then came I to the last figure of the higher summe, and multiply it by 6, saying 6 times 2 make 6 and 2 in my minde make 8, that 8 doe I write under the fourth place And so have I ended the first Multiplier, and dash him streightly with my Pen.

1365
236
8190

Then beginne I with the second Multiplier, and say, first 3 times 5 that maketh 15, of which I set the 5 under the second place, because that the Multiplier is there, and the Article 1 I kæpe in minde.

Then

Then come I to the second Figure that is 6, and multiply it by 3, which maketh 18, and with one in minde maketh 19. the 9 I set downe vnder the third place, and 1 I kéepe in minde.

Then come I to the third Figure, which is 3, and multiply it by 3. saying: 3 times 3 make 9, and with 1 in minde make 10, the Cypher I set vnder the fourth place, and the Article 1 I kéepe in minde.

And then comming to the last figure 1, I multiply it by 3: and it maketh 3, and with the one in mind, it maketh 4, which 4 I set in the fift place. and then haue I ended two of the Multipliers, and the summes stand as you may sée in the latter end of the page going before, and then I giue 3 his dash.

```
 1365
  236
 8190
 4095
```

```
 1365
  236
 8190
 4095
    0
```

Then come I to the third Multiplier, and multiply it into euery figure of the higher sum, and first I say, 2 times 5 make 10, of which I set the Cypher vnder the Multiplier in the third place, and the Article 1 I kéepe in minde.

And so multiplying the second figure 6 by

that same 2, there amounteth 12, and 1 in my minde maketh 13, whereof I write the Digit 3 vnder the fourth place, and the Article 1 I keepe in minde:

Then do I multiply the said 2 by the third figure of the higher summe, which is 3, and that maketh 6, and the one in minde make 7, which 7 I set downe vnder the fifth place, as appeareth by the example.

Then come I to the last place, and multiply that 1 by 2, and there amounteth 2, which I set in the sixth place, and then doth the summe stand thus.

And so haue I ended the whole Multiplication.

But now (as you taught me) to know what this whole summe is, I must adde all those parcels together, and then vnder the line will appeare, as you may see, the grosse or totall summe is, 322140. Wherby I know there is so many yards square in that peece of ground.

```
1365
 236
8190
4095
2730
```

```
1365
 236
8190
4095
 730
```

```
1365
 236
8190
4095
2730
-----
322140
```

Master. This is well done.

Scholar. Then me thinketh I could call it well done, when I know, whether I had well done or no.

Master.

Maſter. It is to be proued by 9 as Addition was, but the ſureſt proofe is by Diuiſion, and therefore I will reſerue that proofe by Diuiſion, till you haue learned the Art of Diuiſion. And anone I will ſhew you how it is commonly proued.

¶ *But firſt, for your further inſtruction in this exerciſe of Multiplication, I will with one example more try your cunning, and ſo make an end: And the queſtion is this. I would know how many dayes it is ſince the Nativity of our Lord and Saviour Ieſus Chriſt, vnto this yeare* 1630. *Which to performe; you muſt multiply this preſent yeare* 1630. *by the dayes in one whole yeare, which are* 365.

Scholar. Now for that you haue giuen me ſo much light into the queſtion, you ſhall ſee I will handſomely finiſh the worke, for according to your former inſtructions, I ſet them downe with a line vnder them, thus.

| | |
|---|---|
| 1630 | |
| 361 | |

Then ſay I, 5 times 0 is 0, which I ſet downe vnder the firſt place, as here appeareth. Then ſay I, 5 times 3 make 15, the digit 5 I ſet downe in the ſecond place vnder 3, and the Article 1 I keepe in minde to bee added to the next Multiplication. Then ſaying fiue times 6 make 30, and 1 in minde 31, the 1 I ſet downe in the third place, and 3 I keepe in minde. Then comming to the laſt figure, I ſay once 5 is 5, and 3 in minde make 8, that I doe I ſet downe vnder the

the fourth place: and thus haue I ended my first Multiplier, and therefore I giue it a dash with my Pen.

Then come I to the second Multiplier, which is 6, and do likewise multiply it into the vpper number, saying, 6 times 0 is 0, which I set down in the second place right vnder his Multiplier: then say I, 6 times 3 make 18, the 8 I set down vnder the third place, and 1 I kæpe in minde. Then say I 6 times 6 make 36, and 1 I kæpe in minde make 37. the Digit 7 I set downe in the fourth place, & 3 I kæpe in mind. Then say I, 6 times 1 is 6, or once 6 is 6, and 3 in mind make 9, which I set down next, & so haue I ended two Multipliers: wherefore I dash the 6 with my Pen.

| | |
|---|---|
| 1590 | |
| 365 | |
| 7950 | |
| 9540 | |

Then I begin to multiply the third Multiplier into the ouer number, saying, 3 times 0 is 0; the 0 I set down in the third place right vnder his Multiplier. Then say I 3 times 3 make 9, which I set down in order next: then say I, 3 times 6 is 18, the 8 I set down, and 1 I kæpe. Lastly, I say, once 3, is 3 and 1 I kæpe is 4, which I set downe orderly next: And so haue I ended the Multiplication, and my figures stand thus.

| | or thus |
|---|---|
| 1630 | 1630 |
| 365 | 365 |
| 8150 | 815 |
| 9780 | 978 |
| 4890 | 489 |
| 594950 | 594950 |

Master.

Master. I commend you for your diligence, the worke is very perfectly done, which parcels if you now adde together into one summe it will be 594950; which is the grosse or totall summe of that Multiplication, and declareth the number of daies since our Lord and Saiour his incarnation, vnto the end of 1630. *yeares, besides 407 dayes, and twelue houres for leape yeares.*

Scholar. This is marueilous, me thinke, that such great matters may so easily bee atchieued by this Art, which heretofore I euer thought had beene impossible, as infinite sorts of people are of that minde.

Master. Truth it is, that knowledge hath no greater enemy then ignorance, for this is one of the least of ten thousand things that may be done by this Art, as hereafter you shall be able to iustifie.

Scholar. The manner of Multiplication I perceiue, if there be no more in it.

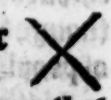
Master. *Yes, there are other formes and helps for ease, and shorter labour of the worke of Multiplication: but I will rewit them till you haue a little tasted Diuision, where also the like helpe into Diuision may be vsed: and so therefore vnder one example for both, will I shew you both ease in Multiplication, and also in Diuision.*

But sith the other formes and workings do nothing differ from these works in effect, but onely in setting of the numbers, I will ouer-passe them till a more méete place and time.

time. And now will I instruct you in Diuision, so that you thinke your selfe sufficiently to perceiue what I haue taught you.

Scholar. Yes Sir, I thanke you, but I do not perceiue how to examine my worke, to try whether I haue well done, or no: therefore as you promised me ere-while, I pray you first shew me how I shall proue it.

Master. *That is commonly vsed by the proofe of 9. as you learned before in Addition, saning that it differeth from that forme in diuers respects: As for example.*

First, you must make a crosse after this manner. 

Proofe of Multiplication.

Then must you examine your summe that should be multiplied, and lok what remaineth after casting away of 9, that set you at the one side of the crosse, then examine the Multiplier, and whatsoeuer remaineth in it after casting away 9 so often as you can, write that at the other side of the crosse: then must you multiply those two numbers together, and lok what amounteth therof, if it be vnder 9, write at the higher part of the crosse: but if it be aboue 9, then take thence 9 as often as ye can, and write the rest at the head of the crosse: As for example, we will proue the example you put forth of the peece of ground that contained 1365 yards in length, and 236 yards in breadth.

Therefore first I cast away all the nines from the summe to be multiplyed, saying, 5

and

and 6 make 11, cast away 9 rest 2: then 3 and 2 makes 5, and 1 is 6, that 6 I write at one side of the crosse thus.



Then do I examine the Multiplier, which is 2 3 6, wherein when the 9 is cast out, there remaineth 2, that 2 therfore I set at the other side of the Crosse.



Then do I multiply 6 by 2, and it maketh 12, from which 12 I withdraw 9, then resteth 3, that 3 doe I set at the head of the crosse. Then do I examine the grosse somme amounting of the Multiplication, which is 322140, where I finde 9 once, and 3 remaining; that 3 I set at the foot of the crosse, and then I see it to agree with the other 3 at the top of the crosse, and so know I that I haue done well: for if they two did differ, then were my worke vaine, and the Multiplication false.



This is the common proofe but the most certaine proofe is by Diuision, of which I will anone instruct you. A sure proofe of Multiplication.

Scholar. Sir, what is the chiefe vse of Multiplication?

Master. The vse of it is greater then you can yet vnderstand: howbeit, these plaine commodities it hath, that if you would resolue any great and whole value into many small and lesse portions, as if you would change

pounds

pounds in ſhillings and pence, or any other greater or ſmaller parcels by Multiplication, ye ſhall do it ſpeedily and eaſily. Alſo if you ſhould néed to adde one ſumme to it ſelfe, or to any other oftentimes, you ſhall do it by Multiplication much more ſpeedily, readily, eaſily, and ſurely, then by often and ſundrie Additions. Take you theſe commodities groſly ſhewed for an anſwer at this time, and hereafter I will more abundantly make you to perceiue the vſe of it.

Diuiſion.

# Diuiſion.

Scholar.

*WEll Sir, then in Diuiſion I pray you to inſtruct mee. But mee thinketh by the name of it, that it ſhould bee all one with Multiplication: for I call that Diuiſion, when any thing is parted into diuers and many parts.*

Maſter. You take it as it is taken commonly: howbeit, if you marke well, you ſhall perceiue that it is quite contrary to Multiplication, and doth not part one thing or few things into many, but contrary wayes, it bringeth many parcels into few, but yet ſo, that theſe few taken together, are equall in valne to the other many: for by Diuiſion, pence are turned into ſhillings, and ſhillings into pounds: As for example; of 120 ſhillings it maketh 6 pounds, ſo are 120 turned into 6, which is a ſmaller number: but then if you conſider the Denominators, you ſhall ſée that they are ſuch that one of the latter is equall to 20 of the firſt, and ſo in valne the ſummes are one, though in number they doe differ, and the latter ſumme is the leſſer, and ſo it is alwaies in Diuiſion, howbeit, yet

in the worke, the summe is parted by another, and thereof doth it take the name.

Scholar. I thinke I shall better vnderstand the reason of the name when I know the vse of the worke, therefore now would I gladly learne that.

Diuision what it is.

Master. *Diuision is a distributing of a greater summe by the vnites of a lesser: Or, Diuision is an Arithmeticall producing of a third number, in respect of two propounded numbers; which third number shall so often containe an vnite, as the greater of the two propounded numbers can containe the lesser.* So that as Multiplication did seeme to serue instéed of many Additions, so Diuision may seeme to be in place of many Subtractions: Because that third number briefly expresseth how many times the lesser of your two propounded numbers may bee subtracted from the greater: as in practise will more plainly appeare. Therefore (as you may perceiue) vnto Diuision are required three numbers: the first, which should be diuided, and that must (generally) be the greater: and the second, by which the other must be diuided, and that is (generally) the lesser, and is called, the Diuisor: And the third, which answereth to the question (How many times?) and therefore is called the Quotient.

A generall rule for placing the figure.

The first must be first written, and the second so set vnder it, that the last figure of the lower number be right vnder the last of the

the higher, contrariwise to the worke of other kinds of Arithmeticke: for in them the two first figures were set euer mete, one vnder the other: but in Diuision, the last figures must be set mete, except it chance so that the last figure of the Diuisor be greater then the last of the higher number, for then you shall set the last of the Diuisor vnder the last saue one of the higher number, as for example. An exception.

If you should diuide 365 (which are the summe of the daies of a yeare) by 28, which are the daies of a common moneth, then should you set them thus.

| | |
|---|---|
| 365 | |
| 28 | |

But if you should diuide those 365 dayes by 52, which is the number of weekes in one yeare, then should you set them thus.

| | |
|---|---|
| 365 | |
| 52 | |

Likewise, if I would diuide the same 365 by 4, which is the summe of the quarters of yeares, then must I set them thus.

| | |
|---|---|
| 365 | |
| 4 | |

Scholar. Sir, this do I vnderstand, but now how should I doe to diuide the one by the other?

Master. You must begin with the last figure next the left hand, and see how many times the last figure of the Diuisor may bee taken out of the last figure of the other number, and that shall you note within a croked line toward your right hand. As for example, I would diuide 365 by 28,

28, then set I those two sums thus.

365 (
28

And I loke how many times I may finde 2 (which is the last figure of the Diuisor) in 3, (which is the last of the number to be diuided) and considering that I can take 2 out of 3 but once, I make a crooked line at the right hand of the numbers, and within it I set 1 and that is called the Quotient number, as I told you. Then because that when 2 is taken out of 3, there remaineth 1, I must write that 1 ouer 3, and deface or cancell the 3 and the 2, then will the figures stand thus:

Quotient number.

1
365 (1
28

Then come I to the next figure of the Diuisor, and take it likewise so many times out of the figures that be ouer it, and loke what doth remaine, that I must write ouer them, and cancell them as in this example.

Therefore now do I take once 8, out of 16, and there remaineth 8, which I must set ouer the 6, and cancell or crosse out the 16, and the 8 of the Diuisor: and then will the figures stand thus. And so haue I once wrought.

18
365 (1-
28

Scholar. So I perceiue that you take the neather figure, not onely out of the other that is right ouer him, but out of that with the other, also

also that remaineth before, and are written toward the left hand.

Master. So must you do: for you must so take the Diuisor out of the ouer number, that there remaine not ouer it so great a summe as it selfe is, for then were your worke in vaine.

But yet againe here must you marke, that when you seeke how many times the last figure of the Diuisor may be found in the number ouer him, that you loke also whether you may as often find all the figures following in those that are aboue them (considering all the remainers, if there be any) if not, take your Quotient lesse by one, and then proue againe, and so still till you finde a méete Quotient: and by that méet Quotient must you alwayes multiply your Diuisor, and set the product vnder your Diuisor, so that the first figure stand vnder the first figure of your Diuisor, and the second vnder the second, and so forth: and then subtract that product from the number to be diuided that standeth directly ouer it, as you haue séene me do.

When you haue thus wrought once, then must you begin againe, and write your Diuisor a new, nearer toward the right hand by one place, as in this example, you shall set 2 vnder 8, and 8 vnder 5, thus.

| | |
|---|---|
| 28 | |
| 3655 | (1 |
| 288 | |
| 2 | |

Then (as before) seeke how many times you may take

your diuisor out of the number ouer him now.

Scholar. That may I do here 4 times.

Master. Truth it is, that you may finde 2 foure times in 8: but then marke whether you can find the figure following so many times in the other that is ouer him. Can you finde 8 foure times in 5?

Scholar. No, neither yet once.

Master. Therefore take 2 out of 8 once lesse.

Scholar. That is three times.

Mark how to consider this kinde of Remainer.

Master. Well then 3 times 2 make 6: if I take 6 out of 8, there remaineth 2: which 2 with the 5 following, make 25, in which summe I find 8 three times also: and therefore I take 3 as a true Quotient, and write it within the croked line of the quotient before the 1, thus.

| | |
|---|---|
| | 2 |
| | x8 |
| | 365(13 |
| | 288 |
| | 7 |

Then say I 3 times 2 make 6, then 6 out of 8 resteth 2, therefore I cancell the 8, and write ouer it the 2 that doth remaine, thus:

Then do I take 8 as many times out of 25, saying: 3 times 8 make 24, and if I take 24 out of 25, there remaineth 1, so then I cancell 25 and 8, and ouer the 5 set 1, thus.

Or, you might (after you found 3 to bee a fit Quotient) ſtraight way haue multiplied the whole Diuiſor 28, by that at once: which giueth 84, which beeing ſet vnder 28, and duly ſubtracted from 85, of the number diuided, giueth 1, the remainer of the whole Diuiſion, as before you had. Worke which way you liſt, here you ſee alſo the ſame.

| | |
|---|---|
| 2 | |
| 281 | |
| 285 | (13 |
| 288 | |
| 2 | |

And now haue I done with the diuiding, for I cannot find my Diuiſor 28 no more in the ouer ſumme.

Scholar. No except you would part the 1, that remaineth into 28 parts.

Maſter. That is well ſaid, and ſo muſt wee doe in ſuch caſes, when there remaineth any thing: but I will let that paſſe now, and will make you perfect in Diuiſion of whole numbers, and will hereafter teach you particularly of broken numbers, called Fraction. Now if you doe perceiue the order of Diuiſion then doe you diuide this ſumme 136280 by 452.

Scholar. Firſt, I ſet downe the number that ſhould bee diuided, then doe I ſet the Diuiſor vnder the laſt figure of the ouer number. Then will it be thus.

| | |
|---|---|
| 136280 | |
| 452 | |

Maſter. Can you take the laſt of you Diuiſor (which is 4) out of 1, which is the laſt of the ouer number?

Scholar. I had forgotten, becauſe the laſt of the Diuiſor cannot be taken out of the laſt of the ouer number, in ſo much as it is the greater, therefore muſt I ſet the Diuiſor one place more forward toward the right hand thus.

1 3 6 2 8 0
4 5 2

And then muſt I loke how often I may find the laſt figure of the Diuiſor (that is 4) in 13, which I may doe 3 times, therefore do I ſay, 3 times 4 is 12, which I take out of 13, and there remaineth 1. Then doe I make at the right hand of my ſummes a crooked line, and write before it my Quotient 3, and I cancell 13 and 4, and ouer the 3 I ſet the 1 that remaineth, and then the figures ſtand thus:

1
1 3 6 2 8 0 ( 3
4 5 2

Then I multiply the ſame Quotient into euery figure of the Diuiſor, & withdraw the ſumme that amounteth out of the nombers ouer them, as firſt I ſay, 3 times 5 make 15, which I taken from 16, and there reſteth 1, I cancell therefore 16 and 5, and write ouer the 6 that I that remaineth thus,

1 1
1 3 6 2 8 0 ) 3
4 5 2

Then doe I ſay likewiſe, 3 times 2 make 6, which I take out of 12 and there reſteth 6, therefore

therefore I cancell the 12 and the 2, and ouer the 2 I write the 6 that remaineth thus.

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xx6
23628o (3
 452
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Then should I set forward the Diuisor into the next place toward the right hand thus.

```
xx6
23628o (3
 4522
  45
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Master. But you may see that ouer the 4 is no figure, therefore I must set the Diuisor yet forwarder by another place.

And marke, whensoeuer it chanceth so, that you should set forward the diuisor, and that it cannot stand there, because there is no number ouer the last place, or if there be any, it is lesser then the last figure of the diuisor, then must you remoue the diuisor, yet once againe: and because that his first place of remouing serued not to subtract him so much as once, therefore you shall write in the Quotient a cipher, and if you should by chance need to do so oft, times, for euery time write a Cipher in the Quotient. The reason of this will I shew you hereafter.

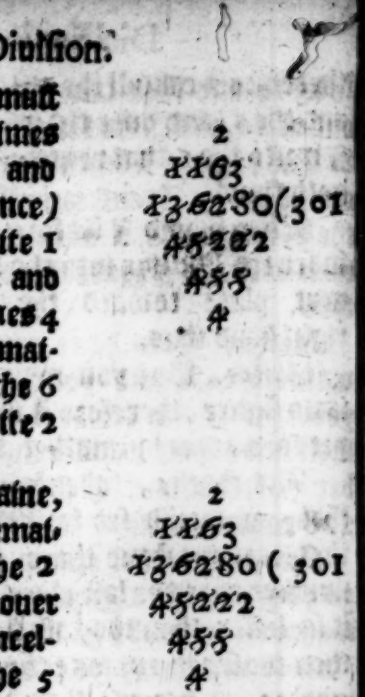
Scholar. Then must I set my summes thus.

```
xx6
23628o (30
 4522
  45
```

And because I remoued the diuisor, so that I ouerskipped one place, I must write a Cypher in the Quotient: and then must I seeke a new Quotient, as

in this example I must say; How many times 4 is there in 6? (and fith it can bee but once) therefore doe I write 1 in the Quotient: and then say I, 1 times 4 taken out of 6, remaineth 2, I cancell the 6 and the 4, and write 2 ouer them thus.

Then say I againe, once 5 out of 28, remaineth 23: I let the 2 stand as it did, and ouer that 8 I set 3, cancelling the 8 and the 5 vnder it thus.




Master. You might as well haue said, once 5 out of 8, and so remaineth 3, but now goe forward:

Scholar. Then once 2 out of 0 cannot bee: What shall I now doe?

Master. Borrow of the next number that is behind (for there is 230) and doe as you learned in Subtraction in a like case.

Scholar. Then must I borrow 1 of the 3 comming behind next, and make that 0

to

to be 10, and then take 12
out of 10, and there resteth 22
8. And because I borrowed xx638
one of the 3, I must cancell xx6280 (301
the 3, and write 2 ouer it: 452xx
then doth the Figure stand 455
thus. 4

Master. Now haue you done, and yet remaineth 228, and your Quotient sheweth you, that if you diuide 136280 by 452, you shall finde your Diuisor in your greater number 301, that is CCC times and once, and 228 remaining.

And in the other example (where I diuided 365 by 28, the Quotient was 13, and 1 remained, whereby I knew that in a yeare (which containeth 365 dayes) there are 13 moneths, reckoning 28 dayes (or 4 weekes) full to a moneth, and 1 day more.

Scholar. Why then do we call a yeare but twelue moneths?

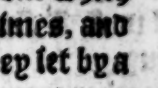
Master. Of that at a more conuenient time will I fully instruct you: but now it is not conuenient to intangle your minde with other things then do directly pertaine to your matter. Therefore if you remember what you haue heard, you haue learned a short manner of diuision, which I would haue you often to practise, so that you may be perfect in it, and hereafter I will shew you certaine other proper points touching it.

Scholar. Then I pray you tell me how

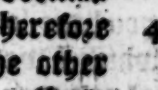
I will examine and try my worke, whether I haue done well or no, that though no man be by me to tell me, yet I may perceiue it my selfe.

Proofe of Diuision.

Master. Some men (yea and commonly most) do try it by the rule of 9. as in all the other kindes, saue that their order is: First, they cast away 9 as often as they can out of the diuisor, and that remaineth they set at one side of a crosse, as in our first example the diuisor was 28, from which you may take 9 three times, and 1 remaineth: which they set by a Crosse thus.




Then they likewise examine the Quotient (which in our example is 13) and from thence they cast away 9 as often as they can, and the remainder they set at the other side of the Crosse, and then they multiply together those two remainers: and to it that amounteth they adde the remainer of the Diuision, if there were any from that whole summe they withdraw 9 as often as they can, and the rest they set at the head of the crosse, as in our example the Quotient is 13, from which take 9, and there remaineth onely 4, and therefore must you set 4 at the other side of the Crosse thus.




Then multiply 4 by 1, and it yeldeth but 4, thereto adde the remainer of the Diuision (which was 1) and it will be 5, which summe doth

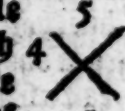
doth not amount to 9, and therefore must be set wholly at the head of the crosse as you see here.




And this number on the head of the Crosse is the first proofe, to which if you find another like in the number that was diuided, then haue you done well.

Therefore now shall you likewise examine the whole summe that was diuided, and take away 9 as often as you can, and that that remaineth, set at the foot of the Crosse: and if it be equall to that in the head of the Crosse, then haue you done well, else not.

As in our example the whole summe was 365, which maketh 14: from that take 9, and there resteth 5, which set at the foot of the Crosse, thus:




And you shall see that they agree: therefore haue you well done.

Now will I likewise examine our second example, where the diuisor was 452, which maketh 11; from thence I take 9, and the 2 that remaineth I set at the right side of the crosse thus:



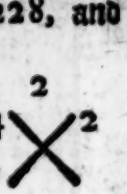

Then examine I the Quotient, which was 301, where I finde but onely 4: that I set at the other side of the crosse, thus:




Then I multiply 4 by

2,

2, and it maketh 8: to that I adde the remainer of the diuision (which was 228, and it maketh 12) and they two make 20, wherein I find twice 9, and 2 remaining: that 2 must I set at the head of the Crosse thus:




Then I examine the whole number to be diuided, which was 136280, where I finde twice 9 and 2 remaining which I set at the foot of the Crosse thus:




And because it doth agrée with the figure at the head of the Crosse, I know that the diuision was well wrought.

The proof of Diuision more certaine by Multiplication.

Master. This is the common proofe. Howbeit, the more certaine working is by the contrary kind: as, to proue diuision by Multiplication thus:

Multiply the Quotient by the diuisor, and if the summe that amounteth, be equall to the summe that should be diuided, then haue you well diuided: else not.

Howbeit, this must you marke, that if there remained any thing after the diuision, that must you adde to the summe that amounteth of the Multiplication. As in our first example our Quotient was 13, and the diuisor was 28: Now multiply the one by the other, & the summe will be 364: to that if you adde the 1 that remained after the diuision, then

then will it be 365, which was the summe that should be diuided: and therefore I know that I haue well done.

Scholar. Now will I proue the same in the second example, whose diuisor was 452 and the Quotient 301: these doe I multiply together, and there amounteth 136052: to which if I adde the 228 that remained, then will it be 136280, which was the whole summe to be diuided: and therefore I perceiue that I haue well done.

Master. This is the surest way, to examine diuision by Multiplication: and contrariwise the surest proofe of Multiplication is by diuision.

And therefore (according to my promise) now will I shew you how you may proue Multiplication by diuision.

Proofe of Multiplication by Diuision.

When you haue ended Multiplication, and would know whether you haue well done or not, set the grosse summe that amounteth, of the Multiplication ouermost, and diuide it by the Multiplier: and if the Quotient be the same number that should bee multiplied, then haue you well wrought, else not, as in that example where wee multiplied 264 by 29, the grosse summe was 7656.

Now if you will know whether that Mulplication be true, you shall diuide that 7656 by the multiplier, 29, and you shall perceiue that the Quotient will be 264, and that is a token that you haue well wrought.

Scholar.

Scholar. By your patience I will proue that, and first set downe the grosse summe and the multiplier, not after the rule of Multiplication, but after the rule of Diuision, for now that number is become the diuiſor, that was before the Multiplier, I shall set them therefore thus:

| | |
|---|---|
| | 7656 |
| | 29 |

Then shall I seeke how many times 2 in 7, that may be 3 times, and 1 remaineth: but then may not 9 be found so often in 16, therefore must I take a lesser Quotient, that is to say 2: then say I, twice 2 maketh 4, which I take out of 7, and there remaineth 3, then doe I cancell 7 and 2, and ouer 7 I write 3, and in the Quotient I set 2: so the figures stand thus:

| | |
|---|---|
| 3 | |
| 7656(2 | |
| 29 | |

Then say I forth, two times 9 make 18, which I abate out of 36, and there resteth 18: then cancell I 3, and ouer him set 1, and likewise I cancell 6 and 9, and ouer them I set 8: so that thus stand the Figures:

| | |
|---|---|
| 1 | |
| 38 | |
| 7656( | 2 |
| 29 | |

Then I set forward the diuiſor by one place, and seeke a new Quotient, that is to say, how many times 2 are in 18, which I find to be 9 times: but then can I not find 9 so many times in 5, therefore I take a lesser Quotient, as to say 8: but yet that is too great: for if I take 8 times 2 out of 18, there remaineth

remaineth but 2, and I cannot find 8 times 9 in 25: therefore yet I take a lesse quotient, that is 7, which is also too great, for if I take 7 times 2 out of 18, there resteth 4, but now I cannot take 7 times 9 out of 45, therefore yet I seeke a lesser quotient, as to say 6, then say I, 6 times 2 make 12, that I take out of 18, & there remaineth 6, so I cancel 18, and the 2, & write 6 ouer 8 thus:

Then say I forth 6 times 9 maketh 54, that take I out of 65, and there remaineth 11, and the Figures stand thus:

Then must I set forth the Diuisor againe & seeke a new quotient, which will be 4: for though I may finde 2 in 11, 5 times, & 1 remaine, yet I cannot find 9 so often in 6, therefore I set the Figures thus:

And the 4 in the quotient I multiply into the figures of the diuisor saying, foure times 2 makes 8 which I tak out of 11, and there rests 3: therefore I cancell the 11, & the 2, and set 3 ouer the first place of 11, thus:

And then doe I say forth, 4 times 9 maketh 36, which

| | |
|---|---|
| | 76556 (26 |
| | 299 |
| | 2 |
| 1 | |
| 76556 (26 | |
| 299 | |
| 2 | |
| 381 | |
| 76556 (264 | |
| 2999 | |
| 22 | |
| 381 | |
| 7656 (264 | |
| 2999 | |
| 22 | |

I take from 36, and there remaineth nothing,

so that the Quotient of this Diuision also (where 7656 is diuided by 99) is 264: Which doth declare, that if 264 be multiplied by 29, the summe will be 7656. And thus I perceiue now how both Multiplication is proued by Diuision, and Diuision also by Multiplication.

Master. Now haue I ended the fiue common kinds of Arithmeticke. For (as touching Mediation Duplation, Triplation, and such other) they are no seuerall kinds of Arithmeticke, but are contained vnder the other. For Mediation is contained vnder Diuision, and is nothing else but diuiding by 2: and so are Duplation and Triplation contained vnder Multiplication: for Duplation is nothing else but multiplying by 2, and Triplation is multiplying by 3, of which I will only propose and example for the rules you haue heard already.

An example of Mediation.

If you would mediate or diuide into 2, this summe 4531010, you shall set 2 for the diuisor, and worke as you learned before, as thus:

```
4531010 (
2
```

Then I finde 2 in 4 two times, therefore my Quotient must be 2: so I cancell 4 and 2, and remoue the Diuisor forward thus, as the worke requireth, and as before in Diuision hath beene declared.

```
4531010(2265505
 2
  ******
```

Which mediation or diuision by 2 being finished

finished, you shall haue for your Quotient 2265505, which is the halfe of 4531010, as you may trie by Duplation; for double that Quotient, or multiply it by 2, and the same number will amount. Duplation.

I will no longer tarry about these, seeing they are but members of the other kinds But here now (according to my promise) I will teach you certaine easie formes both of Multiplication and of Diuision. And first of Multiplication.

If you would therfore multiply any summe by 10, you shall need to do no more but adde a cypher before his first place: as for example, 36 multiplied by 10, make 360. Easie formes of Multiplication.

Likewise, if you would multiply any summe by 100, put two cyphers at his beginning. So if you would multiply any summe by 1000, adde three Cyphers to the beginning of it.

Scholar. This do I well perceiue, and also the reason of it.

Master. I will omit all reasons till our next meeting, when I shall tell you the reason of all other parts of Arithmeticke also: and as to our matter now like, as I haue told you, that you both remember it, and also often practise it.

And now you haue learned how to multiply easily by 10, 100, 1000: and of like manner may you do with any other of like sort.

But now if you will multiply by 20, 30, 40, and so forth, or by 200, 300, and such like, where there is one Cypher in the first place,

or many orderly in the first places, you shall take away those Cyphers and multiply the summe onely by the other figure, or figures, (if they be many) and then at the beginning of the summe that amounteth, you shall set so many Cyphers as you toke away.

Example of 2873, which I would multiply by 300. First I omit the 2 Cyphers from the Multiplier, and I multiply the summe by thée onely that is left, and it amounteth to 8619: before which I put the two Cyphers that I before omitted or toke away, and then is it 861900. And that is the summe that amounteth when 2873 is multiplied by 300.

Scholar. And if there were two or more figures beside the Cyphers, I must onely take away the Cyphers, and multiply by the other figures, as I learned before: as if I would multiply 93648 by 25000, I should take away the thrée Cyphers, and multiply the same by 25, and then at the beginning of that totall summe should I adde the 3 Cyphers againe.

Master. Euen so: but if it chance the number that should be multiplied, or both the summes, as well the number that should bée multiplied, as the Multiplier, to haue Cyphers in their first places, euermore omit the ciphers & worke by the rest. But remember to restore as many Ciphers to the amounting summe as you bated before, as in this example: 30200 shall be multiplyed by 206, I shall onely take away two Cyphers from the grea-

ter

ter number, and then multiply 302 by 206, and afterward adde the two Cyphers againe. But if I would multiply the same 30200 by 2060, I shall not onely take away the two Cyphers from the number that should be multiplyed, but also I may take away the one Cypher from the Multiplier, and then must I adde 3 Cyphers to the summe that amounteth: but take héed that you take away no Cypher that commeth after any signifying figure, as in the last example, you may not take away that in the fourth place of the higher number, neither that in the third place of the Multiplier: howbeit, yet thus you may do: If one Cypher or more come in the midst of your summes you may multiply by the other Figures, and overskip them: but so, that you giue every figure his due place: as thus, I will multiply 3026 by 2004, therefore I set them thus:

| | |
|---|---|
| | 3026 |
| | 2004 |
| | 12104 |
| | 52 |

And thus I doe multiply them. First 4 times 6 make 24, I set the 4 vnder the first place, and kéepe the 2 still in my minde. Then say I againe, 4 times 2 maketh 8, and the 2 that is in my minde maketh 10, I set downe the Cypher 0, and kéepe the article 1 in my minde: Then 4 times 0 is 0, and the 1 in my minde maketh 1, I set downe the figure 1, and say againe. 4 times 3 is 12, I set downe 2, and kéeping the 1 still in my minde (hauing no more places of the vpper number to multi-

tiply it withall) I put it downe next 2 in the fifth place.

But now when I come to the next place (being a Cypher o) I let it go, because it multiplieth nothing, & likewise the second cipher.

But then, when I come to the 2, and multiply it into the 6 of the ouer number, you must take heed (according as I taught you in Multiplication) that the first number amounting of the Multiplication be set right vnder the Multiplier, and the other orderly toward the left hand, according as you may see in this example, which being finished, with the addition thereof gathered together, will stand as this example, sheweth.

| | |
|---|---|
| | 3026 |
| | 2004 |
| | 12104 |
| 6052 | |
| 6064104 | |

Which is indeed wrought so much the sooner and shorter by ouerskipping of the 2 Cyphers: which otherwise (if the same example were wrought at length) it would haue had 2 workings more, as by the same example here also set downe doth appeare.

| | |
|---|---|
| | 3026 |
| | 2004 |
| | 12104 |
| | 0000 |
| | 0000 |
| 6052 | |
| 6064104 | |

Scholar. Sir I thanke you, for I see great ease in this way of Multiplication: (and if you can shew me such like in diuision) you shall greatly further me.

Master.

Maſter. Yes, I will teach you ſome eaſie waies in Diuiſion alſo, and firſt this: If you would diuide any ſumme by 10, you ſhall onely with your pen make a ſquare line betweene the firſt figure of your ſumme and the ſecond, and then haue you done: for the whole number that followeth the line, ſtandeth for the Quotient, and the figure that is before the line, is the remainer: as for example, 3648 diuided by 10 Where 364 is the Quotient, and betokeneth that ſo many times are 10, in 3648, and the 8 after the line is the remainer, which cannot be diuided into 10, but by breaking it into fractions, wherewith I will not meddle yet. Eaſie formes of Diuiſion.

364 | 8

And ſo likewiſe if you would diuide any ſumme by 100 with your pen, you ſhall cut away the two firſt figures, and if you would diuide by 1000, you muſt cut away the three firſt figures, and ſo of any other diuiſor, whoſe laſt figure is 1, and the other ciphers, loke how many ciphers the diuiſor hath, and ſo many figures at the beginning ſhall you cut away with the ſquare line, and they ſtand alwaies for the remainer, becauſe they are leſſe then the diuiſor, and cannot be diuided by it, and the other Figures that are behind the line ſtand for the Quotient.

But now if your Diuiſor haue any other figure in his laſt place then 1, and in all his other places haue cyphers, loke how many

Cyphers they be, cut away ſo many of the firſt figures of the number that ſhould be diuided, and diuide the reſt that followeth the line by that Figure that is in the laſt place, as if it were the whole diuiſor.

Example of 64284, which I would diuide by 300, here muſt I cut away the two firſt figures (for ſo many Cyphers my diuiſor hath) and muſt diuide the reſt by 3, which is the figure in the laſt place of the diuiſor: Firſt therefore I part away the two firſt figures, and the ſumme ſtandeth thus:

642 | 84 (2
3 |

Then doe I diuide 642 by 3, and the quotient is 214: for in 6 I find twice 3 and in 4 once, and 1 remaining, which 1 with the 2 next before doth make 12, wherein I find 3 foure times: and this is a ready way to turne ſhillings into pounds: for ſith one pound doth containe 20 ſhillings, I muſt diuide the whole number of ſhillings by 20. Therefore eaſily to doe it, I ſée that my diuiſor hath one Cypher, and therfore I cut away one figure from the beginning of the whole ſumme of ſhillings and then I doe mediate or diuide by 2 the other figures or ſumme that followeth.

Scholar. I will put an example.

If you would diuide 64287 ſhillings by 20: that is to ſay, if I would turne ſo many ſhillings into pounds, I muſt cut away the firſt figure, that is 7, and diuide the reſt, that is 6428 by 2, ſo ſhall the quotient bée 3214,

whereby

whereby I know that 64287 ſhillings make 3214 pounds, and 7 ſhillings remaining.

Maſter. Now proue by Multiplication whether you haue well done or no.

Scholar. The quotient is 3214, which I doe multiply by the diuiſor 2, and it doth amount to 6428.

Maſter. Hereby you may perceiue not onely that you haue well done, but alſo how by diuiſion you may turne ſhillings eaſily into pounds: and contrariwiſe by Multiplication you may turne pounds into ſhillings.

But here ſhall you ſee amongſt diuers men diuers formes of ſuch diuiſion: but if you marke what I haue told you, you ſhall perceiue eaſily all the wayes. For ſome men doe not cut away ſo many of the firſt figures of the ſumme that they would diuide, as there are Cyphers in the firſt places of the diuiſor: but they ſet all their Cypers orderly vnder the firſt places of the number that they would diuide; and then with the other figure or figures (if there be many) they diuide the reſt of their ſumme. Another manner of the Abriedgement.

Example. If they would diuide 725931 by 3400, they doe ſet their ſummes thus.

| | |
|---|---|
| 725931 | |
| 34 00 | |

And then doe they diuide orderly till they come to the Cyphers: for there they ſtay and end their worke, as in this example.

They ſeeke how often 3 may be found in 7. which is two times, and 1 remaining: therefore

therefore they set 2 in the Quotient, and cancell, 3 and 7, and ouer 7 they set the 1 that remaineth thus:

1
7 2 5 9 3 1 ( 2
3 4 00

Then doe I goe forth saying, two times 4 maketh 8, which they take out of 12, and there remaineth 4, thus:

x 4
7 2 5 9 3 1 ( 2
3 4 00

Then remoue they the diuisor forward, & seeke how often 3 may bee found in 4, which is but once, and 1 remaineth, then set they 1 in the Quotient, & cancell 3 and 4, and ouer them they set that 1, thus.

1
x 4
7 2 5 9 3 1 ( 21
3 4 4 00
3

Then take they once 4 out of 15, and there resteth 11. Or else more easily: Take once 4 out of 5, & there resteth 1: so they cancell the 4 and 5, and set 1 ouer them thus.

1
x 4 1
7 2 5 9 3 1 ( 21
3 4 4 00
3

Then set they forth the diuisor againe and seeke how many times 3 are in 11, which they find three times, and 2 remaining: so they set 3 in the Quotient, & cancell 11 and 3, and ouer them set 2, thus:

x 2
x 4 x
7 2 5 9 3 1 ( 213
3 4 4 4 00
3 3

Then doe they multi-

ply

ply 4 by 3, which ma-
keth 12; that withdraw
they out of 29, and there
resteth 17, of which the
7 must bée set ouer the
9, and the 1 ouer the 2,
thus:

1
12
1417
725931 (213
3400
33

And now are the two Cyphers next ensuing, so that the Diuisor can no more be set forward, and therefore is the Diuision ended, and the Remainer is 1731.

Now the Quotient which is 213, doth declare, that if you diuide 725931 by 3400, you shall finde it therein 213 times, and there remaineth 1731: so shall you finde it, if you worke as I taught you, by cutting away the 2 first figures, because of the 2 Cyphers.

But this must you marke (as you may perceiue by this last example) that if there be left any other remainer in the summe that was behinde the squire line, that the remainer, must be set to the latter end of the first Remainer, which was cut away with the squire line: as if you would diuide 725931 by 3400, after the forme that I taught you, then would your summes appeare thus. Note.

1
12
1417 7
725931 |31 (213
3444
33

So that 17 which remaineth after the line, must be set to the 31 (that was cut away

way with the line) in higher places, as you ſée héere: where that 17 with the 31, do make 1731.

Scholar. Sir, is there no other forme of Diuiſion in práctiſe but this?

Maſter. Yes verily, there are other formes in práctiſe, but becauſe I loue bréuity, I will declare onely one, which I firſt learned of, and is práctiſed by that wórthy Mathematician, my ancient and eſpeciall loning friend, Maſter Henry Brigges, wherein not any one figure is defaced or cancelled. As if I ſhould diuide 72 by 6, firſt place them thus:

Then if you pleaſe you may wríte the diuiſor in a looſe paper that it may móre eaſily without cancelling or defacing eyther wórke be applyed to, and remoued from the diuidend at pleaſure; then apply your diuiſor 6 to 7, the firſt figure of the diuidend, and inquire how oft it may bée had in 7, and ſéeing 6 is but once in 7, ſet 1 in the quotient line, thus:

Write the Diuiſor in a looſe paper, to remoue at pleaſure.

6) 72.

Then multiply the diuiſor 6, by the quotient 1, and ſet the product 6 vnder 7 thus:

6) 72 (1

Then drawe a line vnder 6, and ſubduct

6) 72 (1
6

6 out of 7, setting the remainer 1 vnder 6 thus:

Then bring downe the next figure of the diuidend, and set it with the Remainer 1 vnder the line thus:

And bring the moueable diuisor 6 vnder the 2, and as before enquire how oft 6 is in 12, and finding it to be twice in 12, set 2 in the quotient thus:

```
6) 72 (1
   6
   -
   1

6) 72 (1
   6
   12

6) 72 (12
   6
   --
   12
   12
   --
   0
```

And multiply 6 by that new quotient 2, setting the product 12 vnder the other 12, and subducting it out of the vpper number, there resteth nothing. And since the vnites of this product do stand vnder the vnites of the diuidend, the diuision is ended: otherwise you should proceed as before, bringing downe the next figure; remouing the diuisor, diuiding, multiplying, subducting, &c.

Scholar. This is very easie, but if there be greater numbers propounded, is the operation the same?

Master. If the numbers be neuer so great, the worke is the same without any difference, as shall appeare by this example:

Diuide

Diuide 7890 by 33.

First set them thus, then bring the Diuisor vnder 78, and see how oft it is there found, which is twice, and therefore set 2 in the Quotient, by which multiply the Diuisor 33, and set the product 66 vnder 78, and subduct it out of it thus.

33) 7890 (2

Then bring the next figure 9 downe, and set it with the Remainer 12, it maketh 129, and remoning the Diuisor 33 thereto, enquire how often 33 is contained in 129, and I finde it but thrice, (though at the first it made a shew of more) therefore set 3 in the Quotient, and multiplying 33 by 3, set the product vnder 129, subducting that product out of the number aboue, and proceed as before.

33) 7890 (239 3/33
66
129
99
300
297
3

Then shall you finde the diuisor 9 times in the Remainer, therefore setting 9 in the Quotient, multiply, and subduct as before, and at the last you shall finde onely 3 remaining, which must be set aboue a line after the Quotient, and the Diuisor vnder, as aboue appeareth.

Scholar. Is there no more difficulty in the

the whole Rule?

Master. Not any, although your number be neuer so great, as before I haue said.

¶ And here will I make an end of Diuision, (sauing that I doe request you to exercise your selfe well herein by many summes, till you haue attained some expertnesse therein.)

*For the reasons and conclusions thereof are so many, and so auaileable for all sorts of men whatsoeuer, that if I should speake of the infinite vses thereof, I should rather lacke words then matter.* And therfore recommending it to your iudgement hereafter, vpon your further trauell into the Art, I will here end this Treatise, representing vnto you one example or simple question of Diuision and Multiplication, in stead of many, which is this.

There are foure brasse Peeces. The first of them at a shot spendeth 9 pounds of powder, the second spendeth 5 pounds, the third 4 pounds, and the fourth 2 punds. They are all appointed against the battery of a hold, and there is allowed by the Maister Gunner 700 pounds of powder to be spent by these foure Peeces in this assault. The question is twofold: The first how many shot each Peece shall iustly make about with this 700 pounds of powder? And lastly, how many pounds of powder ought iustly to be allowed to each Peece for his true proportion? Aquestion of shooting in Ordinance.

Scholar.

Scholar. Why Sir, you make me smile, to beare me in hand, that these two demands may be simply resolued by Multiplication and diuision.

Master. Truly that they may, and that you may by and by worke your selfe with a little labour: first adde together their quantities of powder, that is, 9 pounds, 5 pounds 4 pounds and 2 pounds, al which make 20: Diuide the 700 pounds of powder by that 20, and your quotient giueth 35, as here appeareth, which sheweth for most certainty that they shall make iust 35 shootes about.

| | |
|---|---|
| x | |
| 700 | |
| 200 | (35 |
| 2 | |

Scholar. Sir, all this haue I done, and I see it is so, but whether it be true or not, I cannot tell.

Master. To trie the truth of the same, multiply the first peece that spends 9 pounds by 35, & you shall see his allowance, which is 315 pounds of powder. Multiply also the second peece that spends 5 pounds by 35, & you shall finde 175 pounds his allowance: then 4 by 35 and you shall finde 140 pounds his allowance. Lastly, multiply 2 by 35 and you shall finde 70 pounds his allowance. All which foure particular summs you shal adde together by Addition, as here appeareth, and it maketh iust 700 pounds, & so is the question truly absolued.

| |
|---|
| 315 |
| 175 |
| 140 |
| 70 |
| 700 |

Scholar.

Scholar. Truly sir, these excellent conclusions doe wonderfully moue and moue make mée in loue with the Art.

Master. It is an Art, that the further you trauell the moue you thirst to goe on forward. Such a Fountaine, that the moue you drawe, the moue it springs. and to speake absolutely in a worde (excepting the study of Diuinity, which is the saluation of our Soules) there is no study in the Worlde comparable to this, for delight in vnderfull and godly exercise: For the skill hereof is well knowne immediately to haue flowed from the wisedome of God into the heart of man, whom he hath created the chiefe image & Instrument of his praise & glory.

Scholar. The desire of knowledge doth greatly encourage mée to be studious herein: and therefore I pray you cease not to instruct me further in the vse hereof.

Master. With a good will. And now therefore for the further vse of these two latter, that is, Multiplication and diuision; I will briefly shew you the feate of Reduction.

## Reduction.

## Reduction.

Reduction what it is.

*Reduction is, by which all ſummes of groſſe denomination may bee turned into ſummes of more ſubtile denomination.* And contrariwiſe, al ſummes of ſubtile denomination, may be brought to ſummes of groſſer denomination.

Scholar. What call you groſſe denomination, and ſubtile denomination?

Groſſe denomination.

Maſter. That I call a groſſe denomination, which doth containe vnder it many other ſubtiller or ſmaller: as a pound, (in reſpect to ſhillings) is a groſſe denomination: for it is greater then ſhillings, & containeth many of them.

Subtile denomination.

And ſhillings (in compariſon to pounds) are a ſubtile denomination, for becauſe they are leſſer then pounds, and many of them are contained in one of the other: and ſo likewiſe of other things. whatſoeuer thing is compared to other, if it be greater, and containeth many of them, it is a groſſer denomination: but if it be leſſer (ſo that many of them are in the other) then are they called the ſubtile denominations: whereby you may perceiue that one denomination may bee called a groſſe denomination, and alſo a ſubtile, (that is to ſay, a great & ſmall) in diuers comparisons. For ſhillings compared to pounds, are a ſubtile or ſmall denomination: but compared to pence, they

they are a groſſe or great denomination.

Scholar. Now I vnderſtand the name, I pray you teach me the vſe.

Maſter. The vſe is eaſily learned, if you remember what you haue learned before. For if you will reduce any ſumme of a groſſe denomination into a ſumme of a ſmaller or ſubtiler Denomination, you muſt conſider how many of that ſubtiler Denomination do make one of the groſſer Denomination, and by that number or Numerator do you multiply the ſumme: as if you would reduce 20 pounds into ſhillings, you muſt conſider that in a pound are included 20 ſhillings, therefore multiply the one 20 by the other 20, and there will amount 400, whereby you may know that in 20 pounds, are contained 400 ſhillings. Likewiſe, if you would reduce 30 ſhillings into pence, conſidering that in a ſhilling are 12 pence, you muſt multiply 30 by 12, and it will be 360, whereby you may finde that in 30 ſhillings are contained 360 pence. And thus may you reduce any groſſe denomination into a more ſubtiller, by multiplication, if you know how many of the leſſer doe make the greater: of which thing I will anon giue you a briefe Table for the moſt accuſtomed kindes of money, weight, meaſures, and time, and ſuch like: whereby you may know how often each ſubtile denomination is contai-

To reduce groſſe denomination to ſubtile.

To reduce subtile denomination to grosse.

ned in the grosser, when you shall néd it for the foresaid kind of Reduction. And also the same shall serue you, if you would reduce any summe of a subtiler denomination, into a summe of a grosser denomination. For in such Reduction you must consider (as in the other forme) how many of the smaller doe make the greater: and by that number you must diuide the other summe, and the Quotient will declare how many of the greater denomination are comprehended in that summe; as for example: If you would know how many shillings are contained in 3240 d, consider that 12 pence do make 1 s: you must diuide that 3240 by 12, and your Quotient will be 270, whereby you know that so many shillings are in 3240 d. But if you would know further how many pounds are in these 270 shillings, séeing that euery pound containeth 20 shillings: diuide that 270 by 20, and it will be 13, and 10 remaining, whereby you may know that in 3240 d. (or 270 shillings) are 13 pounds and 10 shillings. For euermore the remainer must be named by the name or denomination of that summe that was diuided, which in this place were shillings. And thus may you doe with any other kindes of Denominations.

☞ ¶ Wherefore to the intent you may haue certaine light or knowledge in most common coynes, weights, and measures (which is the chiefe and principallest thing in trafficke to be knowne)

knowne) I haue in each reduction as they come in order, set downe certaine instructions incident thereunto. And first I haue hereunto added this Table, wherein is comprehended, not onely our currant and common coynes, but also the most part of the vsuall coynes of Christendome, with their iust weights and value currant in this Realme of England, intending at the latter end of my Addition to this Booke, to write of the ordinary money vsed in diuers places, and their common values currant for trafficke, with the manner of their exchanges from place to place, &c.

# A Table of the names and now valuation of the most vsuall Gold-coynes throughout Christendom, with their seuerall weight of Pence and Graines: and what they are worth of current English money this present yeare 1630.

| The names and titles of the Gold. | The weight in Pence. | Grains. | The value in Shil. | pence. |
|---|---|---|---|---|
| Great Soueraigne | 10 | 0 | 22 | 0 |
| Double Souer. K. H. | 8 | 1 | 22 | 0 |
| Double Souer. of Q. E | 7 | 7 | 22 | 0 |
| Royall | 4 | 23 | 16 | 6 |
| Halfe Royall | 2 | 11 d. | 8 | 3 |
| Old Noble | 4 | 6 | 14 | 8 |
| Halfe Noble | 2 | 2 | 7 | 4 |
| Angel | 3 | 8 | 11 | 0 |
| Halfe Angel | 1 | 16 | 5 | 6 |
| Salute | 2 | 5 | 6 | 11 ob |
| 2 parts of Soueraigne | 1 | 11 | 4 | 7 |
| George Noble | 3 | 0 | 9 | 9 ob |
| Halfe George Noble | 1 | 1. | 4 | 11 q |
| First Crowne K. H. | 2 | 9 | 6 | 11 ob |
| Base Crowne K H. | 2 | 0 | 5 | 6 |
| Souer. K. H. best | 3 | 14 | 11 | ob q |
| Soueraigne K H. | 4 | 0 | 11 | 0 |
| Edward Souer. | 3 | 15 d | 11 | 0 |
| Elizabeth Souer. | 3 | 15 d | 11 | 0 |
| Elizabeth Crowne | 1 | 19 | 5 | 6 |
| Halfe Crowne | 0 | 19 d | 2 | 9 |
| Unite. | 6 | 12 | 22 | 0 |

Double

| | | | | |
|---|---|---|---|---|
| Double Crowne. | 3 | 6 | 11 | 0 |
| Britane Crowne. | 1 | 15 | 5 | 6 |
| Thistle Crowne. | 1 | 7 | 4 | 40 b q |
| Halfe Crowne | 0 | 19 d | 2 | 9 |
| Crossa dagger | 3 | 6d. | 11 | 0 |
| Halfe Crossa dagger. | 1 | 15 | 5 | 6 |
| Rose Royall | 8 | 21 | 33 | 0 |
| Spurre Royall. | 4 | 10d | 16 | 0 |
| The Angell. | 2 | 23d | 11 | 0 |
| Halfe Angell. | 1 | 11 d | 5 | 6 |

¶ All the seuerall peeces of Gold heretofore mentioned are set downe according to their valuation by the Kings Maiesties Proclamation for Gold, Dated the 23. of Number, 1612.

## A Table of forraigne gold coyne, according to their ancient valuation and seuerall weight in pence and graines.

| The names and titles of the Gold. | The weight in Pence, Grai nes | | The valne in Shil. Pence. | |
|---|---|---|---|---|
| Vnicorne of Scot. | 2 | 10 | 6 | 0 |
| Scotish Cromne. | 2 | 5 | 6 | 0 |
| French Noble. | 4 | 16 | 13 | 4 |
| All soris of French Crownes. | 2 | 5 | 6 | 0 |
| Flanders Riders | 2 | 6 | 6 | 6 |
| Gelders Rideys | 2 | 2 | 3 | 6 |
| Philips Royall. | 3 | 10 | 10 | 0 |
| Philips Crowne. | 2 | 5 | 5 | 0 |
| Collen Gilden. | 2 | 2 | 4 | 8 |
| New And Gild. | 2 | 2 | 5 | 8 |

| The names and titles of the Gold. | The weight in pence, Graines. | | The value in Shil. Pence. | |
|---|---|---|---|---|
| Flaunders Noble. | 4 | 10 | 12 | 0 |
| Halfe Flaun Noble. | 2 | 6 | 5 | 0 |
| Flen: Angell beſt. | 3 | 6 | 9 | 0 |
| Flaund Royall orker. | 3 | 10 | 10 | 0 |
| Carolus Gilden. | 1 | 21 | 3 | 6 |
| Flaunders Royall. | 2 | 6 | 5 | 0 |
| Saron Gilden | 2 | 2 | 4 | 8 |
| Flaunder Crowne. | 2 | 5 | 0 | 0 |
| Philips Gilden. | 2 | 2 | 4 | 8 |
| Halfe Phil. Gilden. | 1 | 1 | 2 | 1 |
| Goldsn Lyon. | 2 | 16 | 7 | x |
| 2 parts of gold Lyon. | 0 | 21 | 2 | 5 |
| 1 parts of gold Lyon | 1 | 19 | 4 | 11 |
| Dauids Gilden. | 2 | 2 | 4 | 0 |
| Horne Gilden. | 1 | 12 | 1 | 11 |
| Old Andre Gilden | 2 | 3 | 4 | 10 |
| Cruſa long Groſſe. | 2 | 6 | 6 | 0 |
| Cruſa ſhort Groſſe. | 2 | 6 | 6 | 2 |
| Mitreyes. | 4 | 10 | 1 | 4 |
| Halfe Mitreyes. | 2 | 10 | 6 | 8 |
| Portigue Cunie. | 2 | 16 | 6 | 0 |
| Golden Caſtilo | 2 | 23 | 6 | 10 |
| Ducket of Aragon | 2 | 6 | 6 | 6 |
| Hungary Ducket. | 2 | 7 | 6 | 4 |
| Double Piſtolet. | 4 | 9 | 11 | 8 |
| Sindle Piſtolet | 2 | 4 d. | 5 | 10 |
| Ducket of Floren. | 2 | 5 | 6 | 4 |
| Double Ducket. | 4 | 11 | 13 | 0 |
| Single Ducket. | 2 | 6 | 6 | 6 |
| Double duc of Rome | 4 | 13 | 12 | 8 |

*It is to be vnderſtood (gentle Reader) that where-as in theſe tables, the weight is called by the name of a penny, it is not meant a penny of ſiluer money, but a penny of Gold-ſmiths weight, which contai-neth 24 Barlycornes. Concerning which, ſee Troy weight in folio 133.*

*So if a man haue not the weight wherewith to weigh any peece of gold, he may doe it with Barly-cornes, being dry, and as it is ſaid, fol. 133.*

## The prices of Gold which the bringers in of forraine Gold ſhall receiue at the Mint, according to the Kings Maieſties Proclamation. Dated the 14 of may, Anno, 1612.

| | |
|---|---|
| For an ounce of *French* crowns, being 22 Karects fine. | 3 li, 6 ſ. |
| For euery ounce of *Spaniſh* Piſtolets, being 21 Karects, 3 graines and a halfe fine. | 3 li, 6 ſ. |
| For Duckets of *Spaine*, being 23 Karects, 1 graine fine at leaſt the ounce. | 3 li, 8 ſ, 8 d |
| For Milreas Cruſado long croſſe. Cruſado ſhort croſſe, the ounce. | 3 li, 6 ſ, 2 d |
| For *Hungary* Duckets being 23 Karects, 1 graine fine at leaſt the ounce. | 3 li, 9 a ſ, |
| For the Checkeen of *Venice*, being 23 Karects, 1 graine fine at leaſt the ounce. | 3 li, 10 ſ, |

For

For *Barbary* Gold, being 23 Karects and digraine fine, at the least the ounce, ——— } 3 li, 9 s,

¶ *And if the said Barbary Gold bee of lesse fineneſſe, abatement to be made according to the rate.*

For Sultaines being 23 Karects, 1 grain fine at least the ounce. } 3 li, 8 s, 8 d.

For all other Gold, being 22 Karects fine the ounce ——— } 3 li, 6 s.

¶ *And being finer, a greater price according to that rate, and being courser, a lesse, so that the bringer in supply the lesse fine, with the more fine, in such sort, that in the totall it makes good the said rate of 22 Karects fine.*

## The price of Siluer, which the bringers in of forraine Siluer shall receiue at the Mint, according to the *Kings Maiesties aforesaid* Proclamation.

For the Ounce of *Spaniſh* siluer money of *Ciuill*. ——— } 5 s.

For the Ounce of *Mexico* money. ——— } 4 s, 10 d,

For

For Ingots of Siluer, being 11 Ounces, 2 d. weight fine, according to the Standard of *England*, the Ounce. —— } 5 s.

¶ *And for other Siluer of more fineneſſe, a better price according to that rate, and for courſer a leſſe: ſo that the bringer in ſupply the leſſe fine with the more fine, in ſuch ſort, that in the totall it makes good the ſaid rate of* 11 *Ounces,* 2 *pence weight fine, according to the Standard of England.*

## Of Siluer Coynes currant in this Realme.

The *Edward* Crowne of 5 s.
The *Edward* halfe Crowne of 2 s. 6 d.
The *Edward* ſhillings, halfe ſhilling, and the three pence.
*Phillip* and *Maries* ſhilling, and halfe ſhil.
The *Mary* Groat, and *Mary* two pence.
Queene *Elizabeth* ſhilling. 9 d. 6 d. 4 d. 3 d. 2 d. 1 d. three farthings, and halfe penny.

HEre would I now expreſſe the values of ſundry other Coynes of diuers Countries, but for three cauſes I now reframe. The firſt and chiefeſt is, becauſe they are not currant by the Statutes of this Realme. Another cauſe is, by reaſon they are ſo vncertaine, that they be neuer long at one rate.

rate. And againe, they are so different in so many places, that it were matter enough for a great Booke to speake sufficiently of them all. Howbeit, because you shall not be altogether ignorant of them, I will shew you the values of some that are most in vse, and first of France.

French Coynes. The most common money are Deniers Soulx, and Frankes: 12 Deniers makes 1 shilling, 20 Soulx make 1 Franke: so that as you see these 3 kindes are like in the rate to pence, shillings, and pounds with vs; but that this is the difference, that their Denyer is but the ninth part of our penny, and so their Soulx (commonly called Souses) go 9 to our shilling, and 9 of their Frankes to an English pound of money. So that 3 of their Frankes make a Noble. And by those three you may practise how to reduce French money into English money, according as I haue set forth here following.

2160 } Deniers make { 240 d, or 20 s.
3240 } { 360 d, or 30 s.
8352 } { 929 d, or 2 li. 17 s. 4 d

2160 Soulx make 240 shillings. And so of other in like rate. As for the rest of their Coynes, I omit them till hereafter, that you haue some vnderstanding in broken numbers.

Flanders Coynes. But now as for the Coynes of Flanders, they be so changeable, that you must know them from time to time: else you cannot reduce them into our money certainly: but yet that

that you haue an example of their money to exercise you withall, you shall take those that be most common: as Stiuers both single and double, Groats Flemish, Carolus and Gyldens. A Flemish Groat is a little aboue 3 Farthings English. A single Stiuer is 1 d. ob. q. halfe farthing. The double Stiuer Carolus is 4 d. ob. halfe farthing. Then there is also the Carolus Gylden, which is worth 20 Stiuers. And the Flemish Noble is worth 3 Carolus Gyldens, and 12 Stiuers.

So that if you would conuert Flemish money or any other kind of money whatsoeuer it be, iustly into Sterling, you must reduce it first into the smallest part of English money that is in that Coyne. As for example: If I would reduce 368 double stiuers into English money (considering that a double stiuer containeth 3 d. farthing) you shall first take how many farthings be in the double stiuer, and you shall finde them 13: therefore multiply the summe of the stiuers by 13, and then haue you their value in farthings, which is 4784. Now, if you diuide that by 4, then there will appeare the number of pence: but better it were to diuide it by 48 (for so many farthings are in 1 shilling) and then will the Quotient declare the summe of the shillings.

Likewise if you would reduce any summe of single Stiuers into English money, you must multiply the summe first by 13, and then haue you reduced them into a certaine summe, that

is

is to wit, halfe farthings, which summe if you diuide by 8, then will amount the summe of pence: or if you diuide it by 96, the summe of shillings will appeare.

But marke this in all Diuision: when ye doe reduce to bring one Denomination into another, if there be any Remainer after the Diuision, that must be named by the Denomination of the grosse summe that was diuided. As for example, I would bring 254 farthings into pence, therefore I diuide that 254 by 4 (for so many farthings make a peny) and the Quotient is 63, which is the summe of the pence, and then remaineth yet 2, which are farthings still. as one may proue by diuiding. And this must be marked in all Diuision, namely, when it is done for Reduction.

Note well.

Danske Money.

¶ Touching Danske Money, they haue their Soulx, whereof 20 is a Liuer: which is 2 shillings sterling. They haue also their Grash, whereof 80 make a Gilden, which is 4 shillings sterling. They haue also Dollors, their common or old Dollor is 35 Grash. New Dollors they haue, which be diuers, some valued at 24 Grash, some at 26, and some at 30. And thus much I thought good to adde to the Author, touching Danske Money.

Spanish money.

Concerning Spanish Money, whereof the most common are Cornadoes, Marueides, Ryals, and Duckets: fiue Cornadoes make a Marueide, 4 Marueides make a Ryall, and

11 Ryals

11 Ryals make one Ducket, so the Ducket containeth 374 Marucides, which is about 5 shillings, 10 pence, sterling. Therefore if you would conuert 124 pounds, 5 shillings, sterling into Duckets, consider that pence is the least value or Denomination named in this question: therefore reduce 124 pounds, 5 shillings into pence, and it maketh 29820 pence: which if you diuide by pence that a Ducket is worth, (which is 70,) you shall haue for your Quotient 426 Duckets, your desire:

In Venice they haue bettes, Souldyes, Lieures 5 bettes make an English penny, 60 bettes a shilling, which is 2 Souldyes, and 20 Souldyes a Lieure of Venice which is a pound sterling: Venice money.

Thus much haue I said of Money: Now will I shew you in like sort, the distinction of weights. Weights.

*After a Statute made Anno* 11. *H.* 7. *there ought to be but one sort of weight. As* 24 *Barley-cornes dry and taken out of the middest of the Eare, doe make a penny weight*, 20 *of those penny weights make an ounce; and* 12 *ounces a pound of Troy weight, by which is weighed Bread, Gold, Siluer, Pearle, Silke, and such like.* But commonly there is vsed another weight called Haberdupoise; in which 16 ounces make a pound. Therefore when you would reduce ounces into pounds, you must consider whether your weight be Troy weight or Haberdupoise: and if it be Troy weight, you must diuide

Troy weight.
A Penny weight.
An ounce
A Pound Troy.

Haberdupois weight.

diuide your ounces by 12, to bring them to pounds, but if it be Haberdupoise, you must diuide them by 16. Now againe, there be greater weights, which are called a hundred, halfe a hundred, and a quarterne, and also a halfe quarterne, &c.

A hundred weight.

Scholer. Why? so there may be reckoned 20 pound. 40 pound, 200 pound, and such innumerable.

Master. All these are numbers of waight, but they haue not common waights made to their rate, as the other haue. And againe these that I did name, are not iust in number as they séeme by their name: for an hundred is not iust 100, but is 112 pound. And so the halfe hundred is 56: the quarter 28, and the halfe quarter 14. And these be the common weights vsed in most things that are sold by weight.

Wooll. Weights. Todde. Stone.

Howbeit there are in some things other names, as in Wooll, 28 pound is not called a quarterne, but a Todde: and 14 pound is not named halfe a quarterne, but a Stone, and the 7 pound halfe a stone. Other names because they differ in many places, and agrée in few, I let them passe.

Sacke of wooll.

But a sacke of Wooll by the Statutes, is limited to be 26 stone.

Cheese weights.

¶ Now in Cheese, though it be sold by the hundred, and by the stone in some places, yet the very weights of it are Cloues, and weyes. So that a cloue containeth 8, pound, and

a

a wey 32 Cloues, which is 256 pound, that is 12 score and 16 pound, and so much weigheth the wey of Suffolke Cheese, and the like is or should be the Barrell of suffolke butter.

The Wey of Essex Cheese containeth six score and sixteene pound, and so much is also the Barrell of Essex butter.

*Moreouer this weight is vsed by the Apothecaries in their Physicall composition, and mixture of medecine, wherein the least is a graine,*

And { 20 Graines / 3 Scruples. / 8 Dragmes. / 16 Ounces } make { A Scruple / A Drachme or Dragme / An Ounce / A Pound. } thus characte-red. { ℈ / ʒ / ℥ / lb. } The Apothecaries weights

Now of weights are made other measures both for graine & liquor. For a pound in Troy weight, maketh a pint in measure, so that 8 pound or 8 pints do make a gallon: halfe a gallon is named a pottle, and halfe a potle is called a quart, which containeth two pints: Now aboue a Gallon the next measure is a Firkin: then the Tercian a Kilderkin, or halfe Barrell, & a Barrell. And by these measures are sold commonly Ale, Beere, Wine, & Oyle, Butter and Soape, Salmon, Herrings, and Eeles. Measures for liquors. A Pint. Gallon. Pottle. Quart. Ferkin. Tertian. Kilderkin. Barrell.

But as these be vnlike things, so the measures of their vessels doe differ, for the measures of them all are as followeth.

Of Ale { the Firkin / the kilderk. / the barrell. } containeth. { 8 / 16 / 32 } Gallons. Ale measure.

Beer meaſure. Of Beer { the Firkin, the kilderk., the barrell. } containeth { 9, 18, 36 } Gallons.

Sope meaſures, both Firkin, Kilderkin, and Barrell ſhould be equall to Ale meaſure:

Sope meaſure.

*Moreouer the Statutes do limite the weight of euery of thoſe three veſſels being empty:*

{ *A Barrell, Halfe a Barrell, A Firkin* } to weigh empty { 26, 13, 6½ } pounds.

Herringes.

*Herrings alſo ſold by the ſame meaſures that Ale and Soape be ſold by.*

Herrings are ſold by the tale, 120 to the hundred, ten thouſand to the laſt.

Salmon & Eelce.

Salmon and Eeles haue a greater meaſure.

Salmon & Eeles { the Butte, the Barrell, halfe Bar., the Firkin } holdeth { 84, 42, 21, 10½ } gallons.

Howbeit, ſome Statutes did limite Eele veſſels equall with Herring veſſels.

Wine meaſures.

Now as for wine veſſels they are ſeldome ſmaller then Hogſheads, which are of 63 Gallons: Euery Hogſhead, is two Barrels: yet there are many other wine veſſels, but of them all ſee this Table; and marke the meaſures one by another.

Of

| | | | |
|---|---|---|---|
| Of wine and oyle | the Runlet | holdeth | 18½ Gallons. |
| | the Barrell | | 31½ |
| | the Hogsh. | | 63 |
| | the Tertian | | 84 |
| | the Pipe | | 126 |
| | the Tunne | | 252 |

But you shall marke that there bée other kindes of Tertians: for there be Tertians, (that is to say) Thirds of Pipes, of Hogsheds, and of Barrels, as well of other things as of wine. Tertians.

Also Malmseyes, and Sacke, &c. the halfe Tun is not called a Pipe, but rather a Butte. A Butte.

And thus much haue I thought méet to tell you at this time.

Scholar. And is that alwayes true?

Master. I haue told you how it should be, but how it is, I may not say: how they doe differ daily from their iust measure, that Gaugiers can tell you better then I. But I will let this passe now, and speak briefly of the other measure.

And as of weights there did spring the liquid measures (whereof I spake last) so of the same springeth dry measures, as Pecks, Bushels, Quarters, and such like, whereby are measured Corne and like graines, also Salt, Lime, Coales, and other like. And this is the order and quantitie of them. Drie measures.

A Pecke is the measure of two Gallons.

A Bushell. A Quarter. A Wey.

*A Bushell* } *fourre Pecks.*
*A Quarter* } containeth { *eight Bushels.*
*A Wey* } *six quarters.*

These are the common names and measures but in diuers places there be diuers sorts.

Strike. Cornocke.

The Bushell in many places is two Bushels, but then is that Bushell there called a Strike: and in some places halfe a quarter is called a Cornocke. But those diuersities are too many to tell you briefly them all: and againe, sith they are against the law and statutes, I count them vnmeet to be vsed.

Measure to mete length, breadth, & thickneſſe.

But now remaineth yet another kinde of measures, wherebymen mete length, breadth, and thickneſſe, and those are, an Inch, a Foot, and such other: whose names and quantities this Table sheweth.

An Inch. Foote. Yard. Elle. Pearch.

3 *Graines of Barley in length make an inch.*
12 *Inches* } *make* { *a Foot.*
3 *Foot* } { *a Yard.*
3 *Foot and* 9 *Inches* } { *an Ell.*
5 *Yards and a halfe* } *make* { *a Pearch.*

1 *Pearch in breadth, and* 40 *in length, doe make a rodde of Land, which some call a rood, some a yard land, some a Farthendele.*

2 *Farthendels* } *make* { *halfe an acre of ground.*
4 *Farthendels* } { *an Acre.*

Acre.

¶ *Mere,* 40 *rods in length do make a furlong,* 8 *furlongs make an English mile, which containeth* 320 *Perches.*

So that an English mile, grounded vpon the Statute, is in length 1760 yards, 5280 foot,

foot, and 6 3 3 6 0 Inches.

Some what greater then the Italian mile of 1000 paces, and 5 foot to a pace.

Here might I tell you many things elſe touching meaſures, and alſo how to reduce ſtrange meaſures to our meaſures, but becauſe it cannot be well done without the knowledge of Fractions, which as yet you haue not learned, I will let them paſſe till an other time, that I haue taught you the knowledge of broken numbers.

Scholar. But yet ſir of the parts of time, I pray you tell me ſomewhat. The parts of time.

Maſter. You know that a naturall day hath 24 houres, and euery houre hath 60 minutes. It needeth not to tell you, that 7 dayes make a weeke, and 4 weekes make a common moneth, and 13 moneths make a yeare, lacking one day, and certaine houres and minutes: but of that I ſhall inſtruct you hereafter. A day. An houre, Weeke, Moneth, Yeare.

*Here will I make an end of Reduction for this time, which though it be counted no kinde ſeuerall of Arithmeticke, you ſee it is no leſſe needfull to be knowne, or eaſier to be done, then any of the other.*

Scholar. Marry ſir, it ſéemeth vnto me much harder then any other ſort, for it requireth the knowledge of ſo many things: but now ſir when you ſée time, I am ready to learne forth, as much of Reduction as you haue taught mée, I remember; but and if I doe at any time forget, I ſhall haue re-

course to the Tables which you set forth for me.

Master. So do you, for it will not be remembred without exercise. But in as much as you understand so much as wee have intreated of, I will now instruct you in Progression.

# Progreſſion.

*Although vntill this day the moſt part of Writers haue defined Progreſſion as a compendious kinde of Addition, yet truly it is not ſo: for Progreſſion (as the very nature of the word doth informe any man) is a going forward and proceeding in numbers, and that regularly and orderly, whoſe place is aptly choſen to be very neere, or rather next after the expoſition of the foure principall parts of Arithmeticke, for in it after a moſt eaſie manner, are all the foure former parts exerciſed and practiſed: and not onely Addition, as cuſtomably is done. Which cuſtome hath beene the cauſe, why it hath ſo ſpecially beene named a kinde of Addition, and defined to be a quicke and briefe Addition of diuers ſummes, proceeding by ſome certaine and reaſonable order.* What progreſſion is.

You ſhall alſo vnderſtand there are infinite kinds of Progreſſions, but for you (as yet) two are ſufficient to be exerciſed in, of which the one I call Arithmeticall, and the other Geometricall.

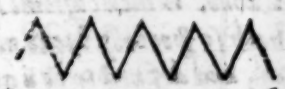
*Arithmeticall Progreſſion is a rehearſing or placing downe of many numbers, number after number, in ſuch ſort, that betweene euery two next numbers rehearſed or placed downe, the difference, diuerſity, or exceſſe, be equall and alike.* Arithmeticall Progreſſion.

Scholar. Sir, I thanke you for that you haue both opened vnto me what Progreſſion is truly, and alſo why it is here placed.

But I pray you with an example make plaine your definition.

Maſter. examples cannot want, ſeing all reaſonable creatures naturally vſe the order of one kind of Arithmeticall Progreſſion (which therefore is alſo named naturall) whenſoeuer they diſtinctly do count or number any multitude by one, ſaying, 1, 2, 3 4 5, 6. whereby the proceeding from number to number, & euery one ſurmounting and exceeding his fellow next before by a like quantity (which here is 1) declareth the ſame to be Arithmeticall Progreſſion. And for the more plainneſſe, I ſet it downe in this manner.

*The common Exceſſe.* 1 1 1 1 1



*The Progreſſion.* 1 2 3 4 5 6

Scholar. This is moſt euident. And I thinke that I am able to tell you now of any Progreſſion Arithmeticall propounded, what is that common exceſſe or difference whereby it proceedeth, if this order be kept in it.

Maſter. What ſay you of 3, 6 9 12, 15?

Scholar. They exceede each other by 3: And that may I ſet downe in ſuch euident order, as you did your example of naturall Progreſſion, in this wiſe.

The

*The common excesse* 3 3 3 3



*The Progression.* 3 6 9 12 15

Master. And doe you not also now perceiue, that the whole Table of Multiplication may be made by the order of Progression Arithmeticall: either if you will begin at the first number of any of them on the left hand, and so proceed right ouerthwart: or at any of the first numbers of the vpper row, and goe directly downe-ward.

Scholar. I pray you let me consider the thing a little, and I will answere you.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 |
| 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 |
| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 |
| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

By this triall I perceiue it now very wel, for the common excesse or difference betweén any two next, is continually as much as the first number of euery row, either from the lefe hand ouerthwart taken, or from any of

of the vppermoſt ouerthwart rowes downeward.

Maſter. Now then, if of any ſuch Progreſſion, you would ſpeedily know the totall ſumme much quicklier then by common Rules of Addition: firſt tell how many numbers there are (which numbers here we call places, or parcels) and if they be odde, write their ſumme downe by it ſelfe; as in this example, 2,4,6,8,10,12,14, where the numbers are 7, as you may ſee: therefore ſet downe 7 in a place alone, then adde together the firſt number and the laſt, as in this example: Adde 2 to 14, and that maketh 16 take halfe of it, and multiply by the 7 which you noted for the number of the ſame places, and the ſumme that amounteth, is the ſumme of all thoſe figures added together: As in this example, 8 multiplied by 7, maketh 56, and that is the ſumme of all thoſe figures.

To know the totall ſumme of an Arithmeticall Progreſſion.

Scholar. That will I worke by another example. I would know how much this ſumme is, 5,8,11,14,17,20,23,26,29 I tell the places and there are 9, that I note. Then I put the firſt number 5, and the laſt 29 together, and they make 34, I take the halfe of it, that is 17, and multipiy by 9, and it maketh 153. That you ſay is the ſumme of all the numbers.

Maſter. So ſhall you finde it if you try it.

Scholar. How ſhall I try it?

Maſter. By your common Addition, for

if

if you adde all the parcels together, you ſhall ſée the ſame ſumme amount, if you did woꝛke well. And that manner of Addition tryeth all kinds of ſumming any Progreſſion.

Scholar. Then can I ſumme any Progreſſion, if the number of the parcels be odde. But what if they bée euen: as in this example, 1,2,3,4,5,6,7,8?

Maſter. When the number of the parcels is euen, then note that alſo as you did beſoꝛe, and likewiſe adde the firſt ſumme to the laſt, and by the halfe of the number of the places doe you multiply it: as in our example, the parcels are 8, that I note: then adding the firſt ſumme to the laſt, there amounteth 9, that do I multiply by halfe of the parcels, that is, by 4, and it maketh 36, which is the ſumme of the parcels.

But if you will take one Rule for theſe both, do thus: Multiply the halfe of the one by the other whole, and the ſumme will amount all one. Foꝛ ſometime it chanceth that the number of the parcels be odde, ſo their halfe cannot be taken: and that ſometime it chanceth the Addition of the firſt number and the laſt, do bꝛing foꝛth an odde number, ſo that halfe of it cannot be taken: but they will neuer be both odde. A generall rule.

Scholar. Then I perceiue this, if there be no moꝛe belonging to it.

Maſter. As accuſtomably it hath béene taught, this hath béene the chiefe and onely exercis

exercise in Progression vsed. But that you may perceiue how diuers wayes, and to how great profit so simple a thing (as this Arithmeticall Progression is) may bee considered and vsed, I will here propound you six propositions: of which foure of them were inuented by a friend of mine, and neuer before thus published: and the two first were neuer to my knowledge written of but by three Men.

Scholar. This doth greatly encourage me to be attentiue vnto your words, seeing I shall not onely be instructed at your hands in the common knowne Rules of this excellent Art, but besides that, so abundantly in other new rules enformed, as my very entrance shall seeme to passe a great many mens further study, and longer continuance. Therefore Sir, I beseech you, let me know your six Propositions.

Master. These they are.

*To know the last number without proceeding by continuall Addition, till you come vnto it, so that the common excesse, the first number, and the number of the places be knowne.*

2 *The first number of the Progression and the last being knowne, with the common excesse to finde the number of the places.*

3 *The excesse being giuen, and the first or last, to know the quantity of any middle number, whose place is giuen from the first or last.*

4 *The totall summe being giuen, and the first and last, to finde out the number of the places.*

The

*The totall ſumme of any Arithmeticall Progreſſion being given, and the firſt and laſt, to find out the common exceſſe.* 5

*The totall ſumme being given, and the mutuall exceſſe, with the number of the places, to giue the firſt or laſt number of the ſame Progreſſion.* 6

Many moe conſiderations could I propound you in theſe *Arithmeticall Progreſſions*, but theſe are ſufficient, to giue you occaſion to thinke, that Rules of knowledge and *Arts* are infinitely capable of enlargement.

Scholar. Happy were I, if I did but well vnderſtand that which is already inuented and written: And yet in my ſimple fantaſie, theſe things offer themſelues (in manner) to be ſtudied for about Progreſſion, therefore I pray you to proceed to the Rules anſwering to theſe propoſitions.

Maſter. I will orderly for euery of theſe ſixe propoſitions giue you Rules, and with euery one an example, vnleſſe the plainneſſe and eaſineſſe need no farther exemplifying.

*For the Solution of the firſt multiply the exceſſe by a number leſſe by 1. then the number of the places and the off-come adde to the firſt number, ſo ſhall haue the laſt number, which is ſought for.* 1 Propoſition.

As for example. If there were ſeuen places in a Progreſſion Arithmeticall, whoſe continuall increaſe or mutuall exceſſe were 4, and the firſt number were 5, and I would know what the laſt and ſeuenth number is: I multiply 6, which is one leſſe then 7, (the number

number of the places) by 4, thereof commeth 24, which I adde to 5, that maketh 29, and that is the laſt number which I deſire to know. And this you may ſtraight way proue by continuall proceeding from 5, till the ſeuenth place, encreaſing euery one by 4, as thus.

5 9 13 17 21 25 29.

Loe heere, the laſt, being alſo the ſeuenth, is 29.

Scholar. I perceiue already one good property in this Rule, which in all workes is to be deſired: that is, it will eaſe one from great labour, if a Progreſſion were propounded of a hundred or two hundred places, or moe: And alſo it is very eaſie to worke, and moſt neceſſary for the total ſumme finding, in a very long Progreſſion:

Maſter. It is true, and therefore now let me ſee if you can anſwer me this queſtion by this propoſition.

A Merchant buyeth 50 pounds of Spices, & agreeth to pay for the firſt pound 4 pence, for the ſecond 7 pence, for the third 10 pence, for the fourth 13 pence, &c.

The queſtion is, how much he muſt pay for the laſt pound, and then how much the 50 pound commeth to?

Scholar. According to the propoſition, I multiply 49 (which is leſſe by one then the number of the places) by the exceſſe, which is

3,

3, to the product 147, I adde the first number which is 4, it maketh 151 pence, the price of the last pound. Now I adde 4, the price of the first pound, to 151 the price of the last pound, it maketh 155, which I multiply by halfe the number of the places, which is 25 the product 3875 pence is the totall summe or price of the 50 pounds of Spices, as appeareth

| | | | |
|---|---|---|---|
| 49 | Places 1 lesse. | 151 | last |
| 3 | excesse | 4 | first |
| 147 | | 155 | |
| 4 | first | 25 | halfe places |
| 151 | the last | 775 | |
| | | 310 | |
| | | 3875 | total summe |
| | | which amounteth to | |
| | | li | s d |
| | | 16 — | 2 — 11 |

Master. It is truely wrought.

Scholar. Then I intreate you to proceede to your second proposition.

Master. *The second Rule is this. From the last subtract the first, the remainder divide by the common excesse, to the* Quotient *adde* 1, *and you have the number of the places, which you would know: As in this Progression.* 2. Proposition.

6 11 16 21 26 31

If I know onely 6 and 31, and that they encrease

encreaſe by 5, then according to the rule, from 81 I ſubtract 6, there remaineth 25: which 25 I diuide by 5, (the common exceſſe) the Quotient commeth forth 5, to which I adde 1, that maketh 6: and ſo many are the places, as you ſee.

Scholar. This Rule is ſo eaſie, that I were much to blame, if I could not remember it.

3 Propoſition.

Maſter. *The third Propoſition may alwayes thus be ſolued. Multiply the* exceſſe *by a number leſſe by one, then the diſtance of the place is from the* firſt, *or the* laſt number giuen: *the ſame adde to the* firſt, *if the* diſtance *be reckoned from the* firſt, *and the* firſt *alſo knowne, or ſubtract from the* laſt, *if the diſtance be from the* laſt counted, *and the* laſt giuen *alſo, and that which commeth forth, either in that* Addition to the firſt, *or* ſubtraction from the laſt *is the number* ſought. As for example, *I propound you this* Progreſſion.

8 15 22 29 36 43 50 57

And for the apt conſidering the manner of this queſtion, I will note ouer euery place his diſtance from the firſt, and vnder euery place his diſtance inclinuely from the laſt, thus.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8 | 15 | 22 | 29 | 36 | 43 | 50 | 57 |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

Now if the exceſſe whereby this Progreſſion

sion standeth, be knowne to be 7, and the first numbers giuen, being 8, I would know what number standeth vnder 4. that is to say, in the fourth place. I multiply 7 by 3, (which is lesse by 1 then the number of the place proponed) that yeldeth 21, to which I adde 8, the first number so commeth 29: which I say to belong to the fourth place, as ye see in the example it also doth: or if in the third place from the last, you would know what number in this example should stand, the last number being knowne to bee 57, and the common excesse 7, then by 2 which is lesse by 1 than the place propounded, I multiply 7, that giueth 14, which appertaineth to the third place inclusiuely reckoned from the last, and so my example giueth you.

Scholar. I perceiue right good vse of this rule: for if I had forgotten what the first number were, and remember still but the last, the common excesse, & the number of the places, then might I come by the knowledge of my first number againe.

And me thinketh, that it differeth not much from the first proposition, sauing that which you make here a middle number, there was made the last: and also in this point it differeth, that in it the last was onely sought, and no consideration had in numbring the places from the last, as here I marke in your numbers noted vnder your Progression.

Master. And thinke you not, the middle

numbers of Progression standing of a hundred or three hundred places or moe, may as much cumber a man to come to the knowledge of them by continuall encreasing from the first by the common excesse, or abating from the last continually the common excesse as the very finall numbers in a shorter progression would doe?

Scholar. Yes sir, that I thinke right well, & therfore I am glad of this new framed proposition, and the manner of the working of it.

4 Proposition. Master. *The rule of the fourth is this. Adde the first and the last together, and by the of-come diuide the totall summe. Double the quotient, and that will be the number of the places.*

Scholar. Then if in a Progression, whose summe were 207, and the first number 12, & the last 57, if I adde 57 and 12 together, that maketh 69, and by it I diuide 207, the Quotient will be 3, which I double: and so I haue 6 and so many must be the number of the places that this Progression standeth on.

Master. Whether it bee so or no, how will you trie?

Scholar. Halfe 6, which is 3, being multiplied by 69, must make 207, the totall summe; if 6 be the number of the places. For so the whole worke of your rule in summing any Arithmeticall Progression did enforme me. I will then multiply 69 by 3, thus,

| | |
|---|---|
| | 69 |
| | 3 |
| It commeth forth iustly. | 207 |

Master

Maſter. I muſt much herein commend your promptneſſe, both in memory and in well applying your rule: although in manifeſt words it did containe no ſuch matter.

Scholar. Sir I pray you here me frame one example more.

Maſter. I am well pleaſed, ſo that ye bee ſhort, for you make mee more longer heere then willingly I would haue been: but I cannot perceiue how I could haue omitted any thing as yet, without your great lacke thereof.

Scholar. If I had receiued 85 pounds of certaine men, but of how many I haue forgotten, yet I remember that the firſt gaue me 7 pound, and the laſt 27 pound, and euery payment after other did riſe by a like ſum. And the man for whom I receiued this mony, conditioned with me, that of euery payment I ſhould haue twelue pence for my labour: now vnleſſe I can by Art finde the truth of this caſe, I am like to loſe the moſt part of my reward. A queſtion of money.

Maſter. I perceiue you can handſomely frame an example, which ſhould concerne your owne gaine: I pray you let me ſee how you would do iuſtice in this point.

Scholar. I adde the firſt and the laſt together, that maketh 34: by which I deuide 85, thus:

| | | |
|---|---|---|
| 1 | | |
| 7 | 17 | |
| 85 | (2— | |
| 34 | 34 | |

Why how now? Sir, here is a remnant of 17, in which 34 cannot be had:

had: so that now I am in the byers for doubling of my Quotient, and farewell then both my Iustice, and a good lumpe of my gaines.

Master. Ye are neuer the farther from the matter, though it fall into a Fraction. For you shall vnderstand, that the Fraction which of any such worke proceedeth, is euer halfe of one such, as the vnites of the Quotient before are. And that you may trie, if you double that which so remaineth, for then it will be equall to your Diuisor, as if ye double 17 (the remnant) it maketh 34, & your Diuisor also was 34 this noteth the remainder to be halfe of one.

Scholar. Now I am glad of this hard example. For with it I haue a generall rule for the Fraction that may hap in this worke. So that the Quotient being two and a halfe, I double that, it maketh 5, therefore should my gaine be 5 shillings. And to be sure (by your leaue) I will trie it, for I will multiply halfe of 34: (which is the first and last number ioyned together) by 5, thus.

| | |
|---|---|
| | 17 |
| | 5 |
| | 85 |

It is most true (I see) that I should leese nothing by the former working.

5 Proposition.

Master. *The fifth proportion hath this rule appertaining vnto it: By the fourth rule finde the number of the places, that being done, from the last subtract the first, & the residue diuide by a number lesse by* 1, *then the number of the places, and the quotient will shew the excesse which is sought for.*

An

An example hereof shall be this: If ye had disbursed 685 pounds to a certaine number of men, you neither can tell how many they were, or how much the ones money exceeded his next before, but you are sure that the excesse was equall betweene euery two next: and also you remember that the first had 19, and the last 180 pounds, how would you finde the number of the name & the excesse, continually obserued in the succession of their payments. Example.

Scholar. Your rule doth plainly bid, first to finde the number of the places, which I will do according to the fourth rule: I adde 19, and 118 together thus.

```
118
 19
---
137
```

By this 137, I diuide 685 thus.

```
137
685(5
```

Seeing there is no fraction but a whole number, being 5, I double that, and then must the number of the places be 10. Now from the last I subtract the first, as 19 from 118, thus: And so remaineth 99.

```
118
 19
---
 99
```

This 99 I diuide by a number lesse by one then the number of the places, and seeing the places were 10, I diuide 99 by 9, thus:

```
99
99(11
```

the Quotient is 1, and so was the excesse, if I haue followed

your rule right.

Master. You haue wrought euery part of this question both well in order, and truly in the practise of your rules.

Scholar. I will then set it downe also formably, so that the number of the places, the excesse and the totall summe may straight appeare, as your first example stood.

The common excesse. The progression.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 19 | 30 | 41 | 52 | 63 | 74 | 85 | 96 | 107 | 118 |

That the places be 10, and that from the first to the last, the common excesse is 11, I perceiue most euidently: but whether the totall summe be 685, I haue not yet proued, which I will now doe: I adde 19 and 118 together, that maketh 137: I multiply that by halfe the number of the places, thus.

| | |
|---|---|
| | 137 |
| | 5 |
| | 685 |

All things agree most exactly, so that I am perfect enough in these rules, if I forget them not againe.

Master. Use maketh all things perfect.

6 Proposition.

*Your sixth rule is this. By the number of the places deuide the totall summe, double the quotient, and that will bee the first and last ioyned in one summe. Then by a number lesse by* 1, *then the number of the places, multiply the excesse, that of-come subtract from the first*

*doubled*

*doubled quotient, and the halfe of the reſidue is the firſt number. The laſt number you may diuerſly finde out; as by the firſt of our ſixe rules, or by ſubtracting this firſt number from the ſumme which here contained both the firſt and laſt ioyntly, (or thirdly) by continuall adding the exceſſe.*

Scholar. I pray you make this somewhat more plaine with an example.

*Maſter.* If euery moneth in the yeere (counting them now as 13) you gained cleerely 40 ſhillings more then you did the moneth next going before, and at the yéeres end you finde the whole gaine 5720 ſhillings, but yee remember not how much either the gaine of the firſt moneth or the laſt was, by this rule it may be tried out. Example of gaine

Scholar. So that here yée ſéeme to apply the 13 moneths to thirtéene places, the 40 ſhillings euery one more then the other next before it, to be the common exceſſe, and 5720 ſhillings to the totall ſumme.

Maſter. It is true: by 13 then I diuide 5720 in this manner.

I double this Quotient ſo haue I 880 for the firſt and the laſt ſumme ioyned together; by 12 which is leſſe by one then the num-

x
x5
x720(440
xzzz
xx

ber

ber of the places; I multiply 40 (the common excesse) so commeth 480

This 480 I subtract from 880, so remaineth 400: halfe whereof is the first number which we desired to know: that is 200.

40
12
80
4
480

And as for the last number, I can give you it three wayes. As by the first of my six rules I multiply the excesse by a number lesse by 1 then the number of the places, as 40 by 12 that giveth 480, which I adde to the first, being 200 so shall the last be 680.

The same summe commeth forth, if ye subtract 200 from 880:

And thirdly, If I beginne at 200, and so proceed, encreasing by 40, I shall at the thirteenth place have 680, as thus:

200 240 280 320 360 400 440
480 520 560 600 640 680

Scholar. I thanke you most heartily for these sixe rules. Now if it be your pleasure I would heare and learne some what of Progression Geometricall.

Master. There are yet very many rules and propositions, which fall into this Arithmeticall Progression.

And for the use and practise of them, I will propone unto you certaine pleasant and necessary questions of Arithmeticall Progression and to the performance of their workings,

such

ſuch neceſſary rules and documents, as are requiſite for the better underſtanding of them, or any ſuch like.

*A certaine Mercer ſold 20 yards of Velvet to be paid in 12 weekes, by Arithmeticall proportion: that is to wit, to receiue the firſt weeke 6 ſhillings, the ſecond weeke 12 ſhillings, the third weeke 18 and ſo forth, encreaſing the number of weekes by 6 ſhillings, till the twelfth and laſt weeke were expired.* The queſtion is how many pounds he had for 20 yards of Velvet. Aqueſtion of Velvet.

6
12
18
24
30
36
42
48
54
60
66
72

To the performance of this queſtion and ſuch other the like, I ſet forth the 12 payments in ſuch ſort, as for exãple, here appeareth. Then touching the adding together of theſe ſummes, without the aid of Addition, according to the rules I taught you in Progreſſion Arithmeticall, I note the number of the places, which are 12, then adding the laſt number of the Progreſſion, which is 72, and the firſt number together, make 78; and multiplying 78 by halfe the number of the places, which is 6, amounteth to 468 ſhillings, and in pounds maketh 23 pounds 8 ſhillings. And ſo much hath the Mercer for his 20 yards of Velvet, which is nigh about 23 ſhillings, 5 pence, a yard.

Scholar. I underſtand this worke very well: but is there any proofe for the iuſtifying hereof,

hereof, as you haue of other worke?

Maſter. The worke of it ſelfe (being ſo perfectly wrought) that in your proceeding and going forward from number to number, each number exceeding his fellow by an equal or like quantity, is all that is demanded for iuſtifying of the ſame: yet notwithſtanding, becauſe your requeſt is reaſonable, I will propone an example for the proofe hereof.

The Proof of the laſt queſtion.

*A certaine man is bound to pay for 20 yards of veluet, the ſumme of 23 pound, 8 ſhillings and it is tobe paid weekely, in 12 weekes or termes by Arithmeticall Progreſſion.* The queſtion is therefore to know with what number the ſame Progreſſion is to be begun and continued in ſuch equall proportion Arithmeticall, that in 12 weekes the ſame may iuſtly bee accompliſhed.

For the reſolution whereof, and of all ſuch other like, reduce 23 pound 8 ſhillings, all into ſhillings, which maketh 468 ſhillings.

A generall rule.

Then adde 1 vnto 12, the number of the termes, it maketh 13, which 13 you ſhall multiply by halfe the number of the termes, which is 6, it maketh 78; then diuide 468 by 78, & you ſhall find 6 in the Quotient, which is the true number that ſhall begin and continue the ſaid Progreſſion. That is to ſay, the firſt weeke 6 ſhillings the ſecond 12 ſhillings, & the third week 6 ſhillings more, which is 18 ſhillings, and ſo euery weeke as they riſe, 6

ſhillings

ſhillings more then the weeke before, as is manifeſt in the queſtion aforeſaid.

*A Farme is to be ſold to be paied by the weekes in a yeare, the firſt weeke to pay 4 ſhillings, the ſecond weeke 8 ſhillings, the third weeke 12 ſhillings and ſo forth, increaſing each number by 4, till the number of 52 (which are the number of weeks in a yeare be expired.)* The queſtion is, what the price of the Farme commeth to? A queſtion of a Farme

Scholar. I doubt not, but by that you haue already taught me, to end this queſtion very well; wherefore I ſet forth the Progreſſion with his exceſſe 52 times.

Maſter. May ſtay a while: And here for your further eaſe (to abridge you of great labour that appeareth to fall out in this queſtion, and ſo may do in any other the like) if a queſtion were propoſed of 100 or 200 places or moe, and that this queſtion, nor any other the like can be ended, vnleſſe you know abſolutely what the laſt number of the Progreſſion at the 52 place is, or ought to bee) I will giue you a generall rule how to know the laſt number of any Progreſſion Arithmeticall, as well as if you had ordinarily proceeded by continuall Addition, till you had come to the laſt worke, which is this.

Multiply the exceſſe by a number leſſe by one then the number of the places, and thereto put the firſt number of the Progreſſion, and you ſhall haue your deſire. A generall rule.

Scholar.

Scholar. This rule is well worth the noting: for if I underſtand you aright, I conſider that my exceſſe is 4, which I multiply by 51, which is one leſſe then the number of the places, and it maketh 204, whereunto I adde the firſt number of the Progreſſion, which is 4, and then it is 208, which you ſay is, or ſhould be the laſt number of the Progreſſion.

Maſter. This is a moſt approued truth, if there were neuer ſo many places.

Scholar. This rule is ſo eaſie, that I were much to blame, if I do not remember it. For by the benefit hereof, I haue ſuch an eaſe and light into this excellent Art, that my firſt entrance doth ſéeme to paſſe a great many mens further ſtudy, and longer continuance.

*Maſter.* Many moe conſiderations could I propound you in theſe *Arithmeticall Progreſſions*; but theſe are ſufficient for a taſte, to giue you occaſion to thinke that *Rules* of knowledge and *Arts*, are infinite capable of enlargement.

Scholar. Happy were I, if I did but well vnderſtand that which is already inuented and written. But theſe things, in my ſimple fantaſie, offer themſelues to be greatly beneficiall vnto the aide of Progreſſion. Therefore now I will go forward with your queſtion.

Now conſidering that the 52 and laſt place is 208, I adde thereunto the firſt number

number of the Progreſſion, which is 4, it maketh 212, which I multiply by halfe the number of the places, which is 26, and it amounteth to 5512 ſhillings. And ſo much is the totall ſumme or addition of this Progreſſion: which maketh 275 pounds, 12 ſhillings, as appeareth here by my Tables.

Maſter. I like well your labour, and commend you for your diligence; I will here propone one example more, and therewithall for this time will end Progreſſion Arithmeticall.

*A certaine man bought 20 Ells of Holland, to be paid in 17 weekes or termes by Progreſſion Arithmeticall. And the firſt weeke to pay 1 ſhilling 8 pence, the ſecond weeke 3 ſhillings, 4 pence, the third weeke 5 ſhillings, the fourth weeke 6 ſhillings 8 pence, and ſo forth, each weeke ſucceeding 20 pence more then the weeke before.* The queſtion is, what the ſumme of his 20 Ells commeth to? A queſtion of Holland

Scholar. Becauſe here is mention made both of ſhillings and pence, I feare there is ſome harder matter contained herein, then in the other before: therefore I pray you worke it your ſelfe, and I will diligently mark your labour.

Maſter. There is no more to be done in this, then in the other before; but becauſe your requeſt is ſo reaſonable, be attentive unto me.

Firſt by the generall Rules I ſeeke to finde out the laſt number of the 17 place, what this

this Progreſſion ought to bée. Therefore here in my Tables multiplying the exceſſe 20 by 16, which is one leſſe then the number of the termes or places, and it commeth to be 320; and thereunto adding the firſt number of the Progreſſion, which is 20 pence, all is 340 pence, or 28 ſhillings 4 pence: for ſo much ought the laſt number of the payments to be.

Then finally, to know what the whole 17 places amount vnto, I adde the firſt number of the Progreſſion and the laſt together, which make 360. Now becauſe 17 is an odde number, whoſe halfe cannot be taken, I take the halfe of 360, which is 180, and multiplying 180 by 17, commeth to 3060 pence, which maketh as you ſée by Diuiſion 12 pound, 15 ſhillings. And ſo much is the buyer to pay for his 20 Elles of Holland. Which 3060 pence if you diuide by 20, the number of Elles that was bought, you ſhall finde 12 ſhillings, 9 pence, and ſo much payed he for an Elle one with another.

The proofe.

A queſtion of debt.

*A certaine man doth owe* 12 *pound*, 15 *ſhil. to be payed in* 27 *weekes or termes Arithmeticall Progreſſion. The queſtion is, to know with what number he ſhall begin and continue the Progreſſion in ſuch equall proportion, as the ſame may be truly*

payed

paid and ſatisfied in 17 weekes.

## The Anſwer.

Firſt I reduce 12 pounds 15 ſhillings, all into pence, which as you ſée héere in may Tables, make 3060 pence, that I let ſtand by a while.

Then I adde 1 to 17, the number of the places or terms, which maketh 18, which I ſhould multiply by halfe the number of the weekes or termes, which is $8\frac{1}{2}$ which $8\frac{1}{2}$ multiplies by 18 cannot well be done, vnleſſe you were acquainted with Fractions or broken numbers, therefore you ſhall let that paſſe and multiply 17. by the halfe of 18: which is 9, (for that is all one with the Multiplication of $8\frac{1}{2}$: and the Multiplication of 9 into 17 maketh as you ſée 153, with which number you ſhall diuide the 3060 pence beforeſaid, and the Quotient bringeth forth 20 pence, which is the firſt number or payment to begin the Progreſſion with all: and ſo each weeke ſucceeding to riſe 20 pence more then the weeke before; and thereby in 17 weekes ſhall 12 pound 15 ſhillings be paid: as before was ſufficiently declared. Thus much for Progreſſion Arithmeticall.

Scholar. Certainely Sir, I know not how to render you condigne thankes for theſe benefits ſhewed mée, which me thinketh are ſo eaſie, delightfull, and pleaſant, that I count my ſelfe happy to be in your company.

Maſter.

Master. I am glad you delight to deal herein, which is an Art of wonderfull dexterity to all sorts of men of what degree or profession soeuer they be. And now will I proceede to Progression Geometricall wherein I will be more briefe, both because I haue beene so long in this part of Arithmeticall Progression, and also for that it would require the knowledge of Rootes and surd numbers, (whereof ye haue learned nothing) if I should frame the like propositions in them as I haue done in these. Therefore I will onely teach you two practises about it, and so end the considerations and workes of these Progressions.

Progression Geometricall.

*PRogression Geometricall is when the numbers increase by a like proportion, that is, if the second number containe the first, 2. 3, or 4 times, and soforth: then the third containeth the second so many times also: and so the fourth the third, and the fift the fourth, wherefore I set these 3 examples*

| | | | | | |
|---|---|---|---|---|---|
| | 3 | 6 | 12 | 24 | 48 |
| | 1 | 3 | 9 | 27 | 81 |
| | 2 | 10 | 50 | | 250 |

Here in the first example you see, that euery number containeth the other (that goeth next before him) two times: and in the second example three times, and in the third example fiue times. Now if you will know how to finde easily the summe of any such number, do thus: Consider by what numbers, they bee multiplied,

multiplied, whether by 2,3,4,5,or any other, and by the same number multiply the last summe in the Progression. To finde the totall summe in any Geometricall Progression.

Scholar. I pray you worke it by this example 2,8,32,128,512,2048, which I have framed by proceeding from 2, and continuall multiply by 4

Master. Then must I multiply the last summe (which is 2048) by 4 also, and it will be 8192. Now must I abate from this summe the first number of the Progression, which here is 2, then resteth 8190: which summe I must divide by 1 lesse then was the number that I multiplyed by. Seeing then I multiplyed by 4, I must divide by 3, so dividing 8190 by 3, the Quotient will be 2730, which is the summe of all the Progression. And now to prove whether you can doe the same, I give you these numbers to adde by this rule 3, 15, 75, 375, 1875, 9375, 46875.

Scholar. I cannot well tell by what number this Progression doth increase.

Master. In any such doubt do thus: Divide the second number by the first, and the quotient will shew you the number that engendreth the Progression.

Scholar. Then is that number in this example 5, for so many times is 3 in 15.

Master. So is it. Now worke as I taught.

Scholar. The last number is 46875, which I multiply by 5, and it yeeldeth 234375, from

which I abate the laſt number of the Progreſſion, that is 3, and there reſteth 2343702, which I diuide by 4, for that is one leſſe then 5, and the Quotient is 585925, which is the whole ſumme of the Progreſſion.

Maſter. If you remember well this, you haue learned the Art of Progreſſion both Arithmeticall, and alſo Geometricall, which you may proue either by ſubtracting of each number alone from the ſumme, and ſo will there nothing remaine: or elſe by adding together of all the parcels, for ſo will the ſame ſumme amount.

A queſtion of Satten. *A Mercer hath* 12 *yards of Satten, which he valueth at* 16 ſhillings *the yard, and ſelleth the ſame* 12 *yards to another man to be paid as followeth: That is to wit, for the firſt yard to haue one ſhilling, for the ſecond yard two ſhillings, for the third yard foure ſhillings, for the fourth yard* 8 *ſhillings &c. doubling each number following, till the twelfth and laſt yard.* The queſtion is, who hath made the better bargaine of the buyer or the ſeller.

Firſt you may ſet downe 12, the number of the yards as you ſée here in this Example. And againſt each number the number of ſhillings due to be paid, as the order of Duplation or Multiplication by two teacheth.

Then reſorting to the adding vp or ſumming of this Progreſſiō, where I conſider that the increaſe of this ſum proceeded by the Multiplication of 2, & therefore after I haue drawne

a

| | |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 4 | 3 |
| 8 | 4 |
| 16 | 5 |
| 32 | 6 |
| 64 | 7 |
| 128 | 8 |
| 256 | 9 |
| 512 | 10 |
| 1024 | 11 |
| 2048 | 12 |
| 4095 | |

a line vnder the 12, I woꝛke and multiply the laſt ſumme by 2 alſo, & it yéeldeth 4096: from whence I abate the firſt number of the Progreſſion, which is 1, and then reſteth 4095: which I ſhould diuide by one leſſe then I did multiply by, but ſéeing it is 1, I néed not to diuide it: foꝛ 1 (as I haue ſaid beforꝛe) doth neither multiply noꝛ diuide; thereforꝛe I take that ſumme 4095 foꝛ the whole ſumme of the ſhillings, which by Reductio amounteth to 204 pounds 15 ſhillings, and ſo much hath the Mercer for his twelue yards of Satten: which is 17 pounds 1 ſhilling, 3 pence a yard. But I thinke you will buy none ſo deare.

Scholar. No Sir, by the grace of God this yeare.

A queſtion of an Horſe.

Maſter. *Then what ſay you to this queſtion? I ſold vnto you an horſe hauing 4 ſhoes, and in euery ſhoe 6 nayles, with this condition, that you ſhall pay for the firſt nayle one* ob: *for the ſecond nayle two* ob: *for the third nayle foure* ob: *and ſo forth, doubling vntill the end of all the nayles.* Now I aske you how much would the price of the horſe come vnto?

Scholar. Firſt to know the number of the nayles, I muſt multiply 6 by 4, and it maketh 24. Then will I do thus: I will write the number of the nayles euery one in order from 1 to 24, and againſt each number of the nayles the ſumme of halfe pence duely, as the order of Duplation or Multiplication by 2 teacheth, and as in the next figure following appeareth.

Then do I reſort to the Rule of ſumming vp the Progreſſion, where I conſider that the increaſe of this ſumme proceedeth by the Multiplication of 2, as the laſt example did. And therefore multiplying the laſt ſumme by 2 alſo, and it yeeldeth 16777216, from which I abate the firſt number which is 1, and then reſteth 16777215, which I ſhould diuide by one leſſe then I

did

| | |
|---|---|
| 1 | 1 did multiply: but ſeeing |
| 2 | 2 that it is 1, I need not to |
| 4 | 3 diuide it, for 1 (as you |
| 8 | 4 haue before ſaid) doth nei- |
| 16 | 5 ther multiply nor diuide, |
| 32 | 6 therefore I doe take the |
| 64 | 7 number 16777215 for |
| 128 | 8 the whole ſumme of the |
| 256 | 9 halfe pence, which by Re- |
| 512 | 10 duction I find to be 699050 |
| 1024 | 11 ſhillings, and 7 pence, halfe |
| 2048 | 12 penie: that is 34952 |
| 4096 | 13 pounds, 10 ſhillings, 7 |
| 8192 | 14 pence, ob. |
| 16384 | 15 Maſter. That is well done, |
| 32768 | 16 but I think you will buy no |
| 65536 | 17 horſe of the price. |
| 131072 | 18 Schol. No ſir, if I be wiſe. |
| 262144 | 19 Maſter. Well then an- |
| 524288 | 20 ſwer me to this queſti- |
| 1048576 | 21 on. |
| 2097152 | 22 *A Lord deliuered to a* Aqueſtion |
| 4194304 | 23 *bricklayer a certaine number* of Bricks. |
| 8388608 | 24 *of loads of Bricke, whereof he* |
| 16777216 | *willed him to make twelue walles, of ſuch ſort, that the firſt wall ſhould receiue two thirdels of the whole number, and the ſecond two thirdels of that which was left; and ſo euery other, two thirdels of that that remained: and ſo did the Brick-layer: and when the 12 walls were made, there remaineth one load of Bricke.* |

Now I aſke you, how many load went to each wall, and how many load was in the whole?

Scholar. Why Sir, it is impoſſible for mée to tell.

Maſter. Nay, it is very eaſie, if you marke it well. Marke well that I ſaid, that every wall ſhould receiue two thirdels of the ſumme that was left. Now take away two thirdels from any ſumme, and you muſt néeds grant that that which remaineth, is one thirdell of the ſumme laſt before: Example of 9, from which if you take two thirdels, there will remaine thrée, which is one thirdle of 9. Likewiſe from thrée bate two thirdels, and there will remaine 1.

Scholar. This is true, and now I perceiue the leaſt wall had but two load of brick.

Maſter. And by the ſame reaſon may you know how many loade euery wall had, according as this figure following doth ſhew, and likewiſe what the whole ſumme of brickes was: for if you make 12 ſummes, multiplying by 3, ſtill from the laſt remainer, as you may ſée here on the left ſide of the Table, there will appeare all the remainers of the whole wall: and if you multiply the laſt of thoſe 12 ſummes by 2 alſo, then will that be the ſumme of the loads which was deliuered to the Bricklayer.

| | | |
|---|---|---|
| | 1 | 122 |
| *The remainer after euery wall.* | 3 | 116 *Loads due to* |
| | 9 | 10 18 *each wall.* |
| | 27 | 954 |
| | 81 | 8162 |
| | 243 | 7486 |
| | 729 | 61458 |
| | 2187 | 54374 |
| | 6561 | 413122 |
| | 19683 | 3393366 |
| | 59049 | 21180 98 |
| | 177147 | 1354294 |
| *Summe of the loades* | | 531440 *deliuered.* |

Againe, if you double euery Remainer, as you may ſée at the right ſide of this Table, thoſe numbers will ſhew the ſumme of loads that went to each wall, whereby you may perceiue that each wall was thrée times ſo great as the next leſſer.

Scholar. Lo now it appeareth eaſie enough. Now ſurely I ſée that Arithmeticke is a right excellent Art.

Maſter. You will ſay ſo when you know more of the vſe of it: For this is nothing in compariſon to other points that may bée wrought by it.

Scholar. Then I beſéech you ceaſe not to inſtruct mée further in this wonderfull cunning.

# The Golden Rule or, Rule of Proportion direct, called the Rule of Three.

Maſter.

The Rule of proportion.

BY order o the Science (*as Men haue taught it,*) *there ſhould follow next the extraction of Rootes of number, which becauſe it is ſomewhat hard for you yet, I will let it paſſe for a while, and will teach you the feate of the Rule of Proportion, which for his excellency, is called the Golden Rule.*

The Golden Rule.

Whoſe vſe is, by three numbers knowne to finde out any other vnknowne, which you deſire to know, as thus.

Queſtion of boarding.

*If you pay for your board for three monthes ſixteene ſhillings, how much ſhall you pay for eight moneths?*

To know this and all ſuch like queſtions, you ſhall conſider which two of your numbers bee of one denomination, and ſet thoſe two the one ouer the other, ſo that the vndermoſt be it that the queſtion is of: as in my queſtion 3 and 8, be both of one denomination, for they both be moneths; and becauſe 8 is the number that the queſtion is aſked of, I ſet the one ouer the other, and 8 vndermoſt thus, with ſuch a crooked draught of lines. Then doe I ſet

3
8

the

the other number which is 16, against 3 a the right side of the line, thus.

3 Z 16
8

And now to know my question, this must I do: I must multiply the lowermost on the left side, by that on the right side, & the summe that amounteth, I must diuide by the highest on the left side: or in plainer words, thus, I shall multiply the number of which the question is asked (which is called the third number) by the number of another denomination (which is called the second, & the summe that amounteth, must I diuide by the summe of like Denomination, (which is called the first) Then for the knowledge of this question, I multiply 8 into 16, and there amounteth 128, which I diuide by 3 & it yeeldeth 42 shillings, and 2 shillings remaineth, which I turne into pence, and they bee 24 pence, of which third part is 8 pence, so the third part of 128 shillings, is 42 shillings, 8 pence, which summe I write at the right hand of the figure against 8 thus.

Note.

The third number.

The second number.

The first number.

3 Z 16 shillings,
8 Z 42 shil. 8 pence

Hereby I know that if three moneths boarding, doe come to 16 shillings, that 8 moneths boarding will come to 42 shillings, 8 pence, & likewise of any other like question.

But here must you marke, that the first number and the third be of one denomination, & also the second and the fourth, for which

you ſéeke: or elſe be of ſuch denominations, that you in working may bring them into one; As if a man ſhould aske me this queſtion.

Queſtion of expences. *Twelue weekes iourneying coſt mee* 14 *French crownes at* 6 *ſhillings the peece, how many pounds is that in one yeare?* Héere you ſée no two numbers of one denomination, but yet in working you may turne them into like denomination: as thus, turne the one yeare into 52 weekes, and the fourth ſumme will bée French Crowns, by the order of the working. They to know this queſtion, multiply the third ſumme 52, by the ſecond 14 and the ſumme will be 728: that diuide by your firſt number, 12, and the Quotient will bée 60. Crownes, and 8 Crownes remaining: which if you turne into ſhillings, they will be 48 ſhillings, which if you diuide by your firſt number 12, the quotient will be 4, which ſignifieth 4 ſhillings: put thoſe 60 French Crownes, which make 18 pounds with the 4 ſhillings, for the ſum that anſwereth to the queſtion, and it is the iuſt expences of a yeare: And the worke will be thus.

| | | |
|---|---|---|
| 12 | 14 | |
| 52 | 60 | 4 l. |

A generall Rule. *And take this euermore for a generall rule touching this whole Art, that the doubtfull or vnknowne number that you would be reſolued of, ſhall alwaies be ſet in the third place. Note alſo the firſt number & the third, muſt euer be of one nature & denomination, or elſe muſt in working be brought*

to

*to like denomination, and then of neceſſity muſt the other number be in the ſecond place.*

*Remember alſo that the place of the firſt number is higheſt on the left ſide, and the place of the ſecond, right againſt it on the right ſide; the place of the third number is vnder the firſt, as by theſe examples you haue ſeene.*

Scholar. This I truſt I can do.

Maſter. But and if the queſtion be asked thus: *In 8 weekes I ſpend 40 ſhillings, how long will 105 ſhillings ſerue me?* Here you ſée that 8 weeks anſwers himſelfe, and ſaith 40 ſhillings. But how long time 105 ſhillings will ſerue you know not. Therefore you ſhall ſet 105 in the third place, according as I told you euen now. And the firſt place muſt alwayes be of the ſame nature or Denomination that the third is of, which here is 40. Then muſt 8 néeds be that other: Now multiply 105 by 1, and it will be 840, which if you diuide by 40, it will yéeld 21, which is the fourth number, and ſheweth how many weekes 105 ſhillings will ſerue, if you ſpend 40 ſhillings in 8 weekes.

The figure of this queſtion is this: as if you ſhould ſay: if 40 ſhillings ſerue for 8 weekes: 105 will ſerue for 21 weekes

| *Shillings.* | *Weekes.* |
|---|---|
| 40 | 8 |
| 105 | 21 |

Other diuerſities there be of working by this rule, but I had rather that you would learne this one well, then at the beginning

to trouble your minde with many formes of working, sith this way can doe as much as all the other, and hereafter you shall learne the other, more conuenently.

Note. ¶ And for your further aid and instruction, to make you better acquainted with this Golden Rule, I haue here proponed six questions, and their answers, which I thinke most conuenient and meete to preferre the desirous to perfect vnderstanding. The first foure are all branches of one question sprung out of the best tree (for a yong learner to taste of) that groweth in this *Ground* of *Arts*: for that no manner of question in the Rule of Three whatsoeuer it be, can be proponed, but it must be comprehended vnder the reason or stile of one of these foure.

The Questions.

*If* 15 *elles of cloth cost* 7 pound 10 shillings *what comes* 27 *elles to at that rate?* Answer 13 pound 10 shillings.

*If* 27 *elles cost* 13 pound 10 shillings *what are* 15 *ells worth?* Answer 7 pound 10 shillings

*If* 27 *elles cost* 13 pound 10 shillings: *how many elles shall I haue for* 7 pound 10 shillings Answer: 15 *Elles.*

*If I sell* 15 *elles for* 7 pound 10 shillings: *how many elles are to be deliuered for* 13 pound 10 shillings? Answer; 27 *Ells.*

*If* 8 *pound of any thing cost* 16 shillings 6 pence,

pence: *what money is to bee receiued for* 49 pound? Answer: 5 pound, 1 shilling od $\frac{1}{4}$.

*If* 4 pound *of any thing cost* 17 pence: *what money will* 8765 *pound of that commodity cost?* Answer: 155 pound, 4 shillings, 3 pence, q.

Of all which questions, I omit the worke of purpose, that you shall whet your wit thereby at conuentent leasure, to clime each branch, and gather the fruit of them, and do minde now, before we make an end of this Rule, to giue you some instructions of the backer rule of three, whose order is quite contrary to this that you haue learned.

Scholar. I thanke you heartily for the fixe Questions, which I will God-willing practise at conuenient times: I pray you proceed therefore to the Backer or Reuerse Rule.

# The Golden Rule, or Rule of Proportion Backward, or Reuerse.

Master.

Note this well.

IN the former Rule euermore looke how much the third number is greater then the first, so much the fourth number is greater then the second. And contrariwise:

The backer or reuerse rule of three.

looke how much the first summe is greater then the third (if it doe chance so) so much is the second summe greater then the fourth.

But in this rule, there is a contrary order, as this: That the greater the third summe is aboue the first, the lesser the fourth summe is beneath the second: and this rule therefore you may call the Backer or Reuerse Rule, as in example.

Question of cloth.

*If I haue bought 30 yards of cloth of two yards breadth, and would haue Cannas of three yards broad to line it withall, how many yards should I need?*

Scholar. Why, there is none so broad.

Master. I doe not care for that, I doe put this example onely for your ease vnderstanding: for if I should put the example in other measures, it would be harder to vnderstand. But now to the matter: If you would know this question, set your numbers as you did

did before: but you ſhall multiply now the first number by the ſecond, and that ariſeth thereof, you ſhall diuide by the third: which thing if you do here, I meane if you multiply 30 by 2, it will be 60: which ſumme if you diuide by 3, there will appeare 20: whereby I know, that if 30 yards of cloth of two yards broad, ſhould be lined with three yards broad, 20 yards of canuas would ſuffice as this figure ſheweth. Note.

| | *Breadth.* | *Length.* |
|---|---|---|
| | 2 | 30 |
| | 3 | 20 |

And now becauſe ye found fault with my Example, how ſay you, perceiue you this?

Scholar. Yes Sir, I ſuppoſe.

Maſter. *Then anſwer me to this queſtion: how many Elles of Canuas of Elle breadth, will ſerue to line 20 yards of Say, of three quarters broad?*

Scholar. In good faith Sir I cannot tell, for I know not how to bring the ſummes to like Denominations.

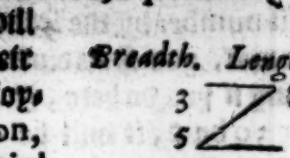
Maſter. Then will I tell you, ſith there is mention here of quarters, and againe euery one of the meaſures both elles and yards may bee parted into quarters, part them ſo both in the breadth and length, and then put forth the queſtion by quarters.

Scholar. Then I ſhall ſay thus. How many quarters of canuas of 5 quarters broad, will line 80 quarters of 3 quarters broad?

Maſter.

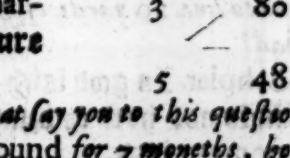
Maſter. Now anſwer to the queſtion.

Scholar. Firſt I will ſet them downe in their forme thus: for 5 is ioyned with the queſtion, and is therefore the third number: then is 3 the number of the ſame Denomination, I meane becauſe they be both referred to breadth. Now I multiply 80 by 3, and it is 240, which I diuide by 5, and it yeeldeth 48. Then ſay I that 48 quarters of 5 quarters broad, will ſuffice to line 80 quarters of three quarters broad.



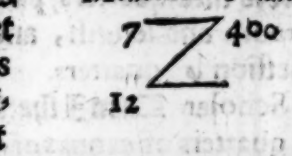

Maſter. Turne the quarters againe into ells and yards.

Schollar. Then I ſay, that 9 ells and three quarters of a yard of ell broad, will ſerue to line 20 yards of three quarters broad, as this figure ſheweth.




¶ Maſter. *Now what ſay you to this queſtion: I lent my friend* 400 pound *for 7 moneths, how much money ought hee to lend mee againe for* 12 *moneths to recompence my curteſie ſhewed him: can you anſwer to this?*

Scholar. Yes Sir, I ſuppoſe, for I will ſet downe my Numbers thus: where I multiply 7 into 400, and it maketh 2800, which I diuide by 12, and it yeeldeth



yéldeth 233 pound, and there is 4 pound remaining of my Diuiſion, what ſhal I do therewith?

Maſter. Turne the ſame 4 pound into ſhillings, & then diuide it by 12 as you did before.

Scholar. Well Sir, it ſhall be done: ſo haue I 6 ſhillings, for my Quotient, and yet remaineth 8 ſhillings vpon my Diuiſion.

Maſter. You muſt alſo reduce that 8 ſhillings into pence, which maketh 96, and diuide that alſo by your Diuiſor.

Scholar. So haue I done, and I finde 8 pence for my quotient, and nothing is left.

Maſter. This muſt you alwaies doe when any thing remaineth vpon your Diuiſion, whether it be money, weight, meaſure, or any kind of thing whatſoeuer. This Rule is ſo profitable for all eſtates of men, that for this rule onely (if there were no more but it) all men were bound highly to eſteeme Arithmeticke.

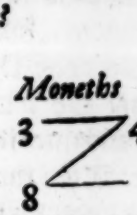
By this rule may a Captaine in warre worke many things, as Maſter Digges in his Stratico̅s doth declare: Only now in this my ſimple addition, for a taſte & incouragement, I will inlarge the Author with a queſtiō or two more, wiſhing you and euery my Countrimen or Gentlemen whatſoeuer, that by nature be any thing giuen to Military affaires, to be familiar and acquainted with this Excellent Art, the which he ſhall find not onely at the Sea, but alſo in the Campe and Field-ſeruice, abaundantly to aid him, either in fortification paying

ing of Souldiers wages, charges of Ordinance, Powder, Shot, Munitions, and Inſtruments, whatſoeuer, as for example.

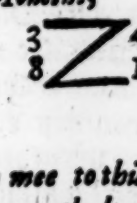
Queſtion of an Army.

*If it ſhould chance a Captaine which hath* 40000 *Souldiers to bee incloſed with his Enemy, that he could haue no freſh purueyance of victuals, and that the victuals which hee had would ſerue that Armie but onely three moneths, how many men ſhould he diſmiſſe to make the victuall to ſuffice the reſidue eight moneths?*

Scholar, As you taught me, I ſet the numbers thus, ſaying: if three moneths ſuffice 40000, to how many will eight ſuffice.




To know this; I multiply the firſt number 3 into the ſecond 40000, and it yeldeth 120000, which ſumme I diuide by 8, and there will be in the quotient 15000, which if I doe ſubtract from 40000, the remainer will declare that he muſt diſmiſſe 25000 as this figure ſheweth.



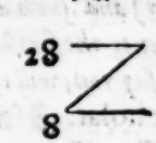

Aqueſtion of a Fort.

¶ Maſter. *Now anſwere mee to this queſtion: If* 136 *Maſons in a moneth bee able to build a Fort to preſerue the Souldiers from the Enemy, and ſuch expedition requireth that I would haue the ſame finiſhed in eight dayes: how*

*how many workmen ſay you is there to be appointed.*

Scholar. As you taught mee; I ſet the numbers thus, ſaying:

If 28 dayes require 136 Maſons, what number of men by the like proportion will 8 dayes require?




To know this, I multiply the firſt number 28 into 136; and it yeldeth me 3808: which I diuide by 8, and my Quotient is 476: which is the iuſt number of Maſons that ſhall ſupply this worke. And now me thinke theſe queſtions are very eaſie.

Maſter. Truely if you take delectation herein, you ſhall finde this Art not onely eaſie, but wonderfull pleaſant and profitable. Now therefore one queſtion more I will propoſe, and ſo leaue off this Rule in whole numbers, vntill we come to the vſe of it in broken numbers: for had you the vnderſtanding of broken numbers perfectly, not onely in this Rule, but in all other, the queſtion that in the ſight or appearance ſeemeth to bee 100 times more harder to abſolue, may thereby be wrought as ſone, or ſoner then this.

Scholar. Your words do greatly incourage me to be ſtudious to attaine whole numbers: but might I once attaine to be a practitioner in broken numbers, I ſhould thinke my ſelfe happy.

Maſter. *What ſay you then to this queſtion? If* 48 *loyners in two dayes make* 200 *light horſemen ſtaues (eſteeming they worke but* 12 *houres a day) and ſuch need requireth that* 384 *loyners are ſet to the finiſhing of thoſe* 200 *ſtaues; in what time ſay you, will they make them vp?*

Scholar. I ſée héere that I muſt turne my 2 dayes into houres. And ſo doing, I ſet my numbers thus:

48 / 24
384

Saying, if 48 men are 24 houres, 384 men will make an end quickly. For it is grounded vpon an old Prouerbe, *Many hands make quicke ſpeed.*

I multiply 48 into 24, and it amounteth to 1152, which I diuide by 384, and my quotient is three houres, which is my deſire.

Note. *I take this for a note worthy the marking, either in the Rule of Three, forward or backward, when the two numbers are multiplied together, the Product is of the ſame nature and denomination that the ſecond number is of.*

The

# The double Rule of Proportion direct.

Master.

WEll, sith you perceiue now the vse of this Rule, I will shew other which ensue of the same, & first the *Double Rule* which is so called, because there is in it double working, by which thing onely it differeth from this. The double Rule.

Scholar. Then by an example I shall vnderstand it well enough.

Master. *So shall you, and let this be the example:* Question of carriage *If the carriage of* 100 *weight (that is* 112 *pound)* 30 *miles do cost* 12 *pence, how much will the carriage of* 500 *weight cost, being carried* 100 *miles?*

Scholar. I pray you shew me the working of it.

Master You must make two workings of it: the first thus: If C weight cost 12 pence, how much will fiue hundred weight cost? Set your figures thus:

| *C Weight.* | *Pence.* |
|---|---|
| 1 | 12 |
| 5 | |

And multiply 5 by 12, and thereof amounteth 60, which if you diuide by one, the quotient will be still 60, that is the price of 500 weight for 30 miles.

Then begin the second worke, saying: If

30 miles coſt 60 pence, how much will 100 miles coſt? Set your figures thus:




Then multiply 100 by 60, whereof amounteth 6000, which being diuided by 30, will yéeld 200 pence. Then you may ſay, that ſo many pence ſhall coſt the carriage of 500 pound weight 100 miles, after the rate of 12 pence for the 100 carried 30 miles.

Scholar. Now I perceiue it alſo.

¶ Maſter. Theſe and ſuch other like queſtions of the double Rule of Three, are to bee anſwered much ſooner, at one onely working by the Rule of proportion compoſed of fiue numbers, which anon I will ſhew you, and then when you haue the vſe thereof, you may vſe which way you thinke good.

Scholar. Sir, I thanke you much for your courteſie, and I long now till this Rule be ended, that I may ſée how I ſhall behaue my ſelfe with that new Rule of fiue numbers: for that I haue euer ſince you taught me hitherto in the Golden Rule both forward and backward, wrought but with three numbers onely.

Maſter. But yet awhile we will go on forward with this Rule of Three, therefore anſwer to this queſtion.

Queſtion of ſowing. Thirty buſhels of wheat ſowed, yeelded in one yeare 360, how many will 80 buſhels yeeld in 7 yeares? I meane ſowing euery yeare

yeere of those seuen, still 80 bushels?

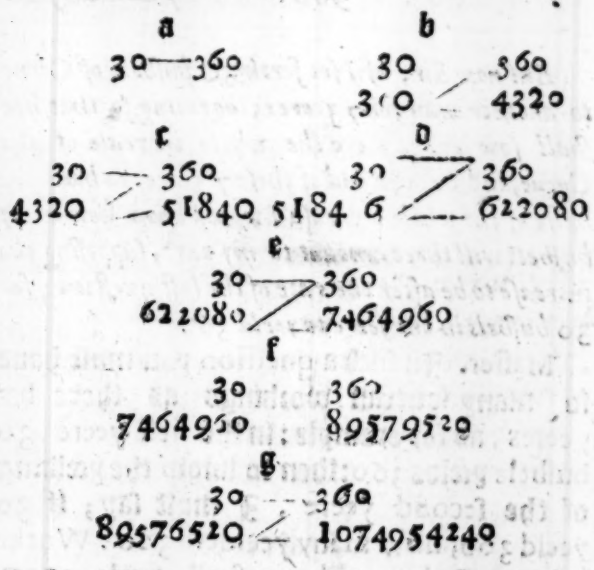
Scholar. First I say, that if 30 bushels will yéeld 360 in one yéere, then 80 bushels will yéeld 960 in one yéere. Then for the second worke I say. If one yeere yeeld 960, then 7 yeeres will yeeld 6720: as these two figures doe shew.

| *Seede.* | *Encrease* | *Yeere.* | *Encrease.* |
|---|---|---|---|
| 30 | 360 | 1 | 960 |
| 80 | 960 | 7 | 6720 |

*But now Sir, if I set forth 30 bushels of Corne to another man for 7 yeeres, agreeing so that hee shall sow euery yeere the whole increase of the Corne, and I at the end of these 7 yeeres to haue the halfe of the whole increase: I would know how many bushels will three amount to my part, supposing the increase to be after the rate of the last question, for 30 bushels in one yeere to yeeld 360?* Question of Corne.

Master. In such a question you must haue so many seuerall workings as there bee yeeres, as for example: in the first yeere 30 bushels yéelds 360: then to know the yéelding of the second yeere, I must say; If 30 yeeld 360, how many yeeldeth 360? Worke by your Rule, and you shall finde 4320. Then say for the third yeere. If 30 yeeld 360, how many will 4320 yeeld? You shall haue 51840, and so euery yeere multiplying the whole increase by 360, and diuiding

ſt by 30, the increaſe of the next yeere will amount, as theſe 7 figures following doe orderly declare: where I haue ſet 7 letters for the 7 yeeres, of which the firſt is ſet without Art, becauſe that is the increaſe which you do preſuppoſe: and the laſt number of each other doth ſhew the increaſe of that yeere that it ſtandeth for, which the letters doe declare, ſo that the increaſe of the ſeuenth yeere, is 1074954240 buſhels: how many quarters that is, and alſo how many waies you may by Reduction ſone finde.




Queſtion of mowing.

Now with one queſtion more I will proue you: *If ſix Mowers do mow 45 acres in fiue daies, how many mowers will mow 300 Acres in ſix daies?*

Scholar.

Scholar. If 45 acres require 6 Mowers, then 300 Acres requires 40. Now againe: if fiue daies require 40 Mowers, then 6 daies neede but 33 Mowers.

Master. Why doe you not make mention of the 2 that remaineth in the last Diuision? for the last part of the question is wrought by the Backer rule, where the first number 5 is multiplied into the second, that is 40; whereof amounteth 200, which if you diuide by the third number 6, the Quotient will be 33, as you said: but then will there remaine 2 which cannot well be diuided into 6 parts: howbeit you may vnderstand by the 6 part of 2, the third part of one Mans worke, which you must put to the 33: or else you must say that 33 Workemen will end all the 300 acres in 6 daies saue 2 mens worke for one day or 2 daies worke for one man. But such broken numbers called Fractions, you shall hereafter more better perceiue, when I shall wholly instruct you of them.

¶ Master. *Yet one question more of field matters I will propone, and so I will make an end of this double Rule of Three.*

Scholar. With all my heart Sir I thanke you, and I will dispatch it as soone as I can, because I would faine see the order of the next Rule of 5 numbers.

Master. *If a Captaine ouer a band of men did set 300 Pioners a worke, which in eight houres did cast a trench of 200 Rods: I demand how many* Question of entrenching.

*labourers*

*labourers will be able with a like trench in three houres, to intrench a camp of* 3400 *Rods.*

Scholar. I thinke I am now in the Backe-house ditch: for I know not well which way to goe about it. And besides that, truely I thinke I shall neuer come to preferment that way, my growth is so small.

Master. You know not how God may raise you hereafter by knowledge and seruice into the fauour of your Prince, for the auaile of your Country.

Example for nauigation: Sir *Francis Drake*, a man greatly honoured for his knowledge, was not the tallest man, and yet hath made as great an aduenture for the honour of his Prince and Country, as euer Englishman did.

Scholar. Sir, I thanke you for your good incouragement. My minde, though I be little, is as desirous of know-ledge, as any other: I haue pondred now a little of it, and thus I set forth the worke.

| *Rod* | *Men* |
|---|---|
| 200 | 300 |
| 3400 | |

Saying, if 200 Rod require 300 men, what shall 3400 rods require? I multiply 3400 by 300, and it yeeldeth 1020000, which I diuide by 200, and my quotient is 5100 men,

Then must I say for the second worke, if in 8 houres 5100 men, be able to discharge it, how many shall performe the same in three houres; Now if I would worke by the Golden

Golden Rule of Proportion forward, I should finde a lesse number of men: because three houres is lesse then 8 houres: but because reason teacheth me, that the lesser the time is, wherein the trench must be made, the more Labourers I ought to haue, thereupon I vse now the Backer Rule, as in example. And I haue in my Quotient 13600. So many Pioners must I haue to intrench the Campe in three houres.

Master. You haue answered the question very artificially: And truly I commend you for your diligence and apt vnderstanding: and now according to my promise, I will (in whole numbers) giue you a little taste of the Rule of Proportion, compounded of fiue numbers.

The

# The Rule of Proportion, composed of 5 Numbers.

The first part of the rule of proportion compound, direct.



*This Rule of Proportion composed, is distinct for most needfull questions, into seuerall parts or workings: And there belongeth vnto it alwayes fiue numbers, whereof in this rule being the first part, the second number and the fifth, are alwayes of one nature and like denomination, which Rule is to be wrought thus: you must multiply the first number by the second, and that shall be your Diuisor: Then againe, multiply the other 3 numbers, the one by the other, and their product shall be your dividend.*

And now according to my promise, we will first worke the question of weight and carriage, which I deliuered you in the double rule of three, to be absolued by this rule, which was this.

*If the carriage of 1 C weight 30 miles cost 12 pence, what will the carriage of 5 C. weight stand me in being carried 100 miles?*

*C. weight. Miles. Pence. C. weight. Miles.*

1——30——12——5——100

Now marke well how these fiue numbers stand: Then multiply the first number by the second, as 30 by 1, which maketh but

30,

30. that number kéepe for your Diuiſor. Then multiply the other three numbers, the one into the other: that is to wit, 12 by 5 which maketh 60: Laſtly 60 by 100 which as you ſée here in our Tables, ariſeth to 6000, which 6000 you ſhall diuide by the product of the two firſt numbers, which here is 30. And you ſée there is found 200 pence, which is the duty that you ought to pay for the carriage of 500 weight 100 miles, after the rate of 12 pence a hundred, and agréeth with the concluſion of the double Rule of three.

Scholar. Sir I thanke you it is euen ſo.

Maſter. *Yet note this for a generality in this rule, looke what nature or denomination your middle number is of (which here are pence) and of the like denomination or nature is alwayes your quotient.* Note this.

Scholar. Well now and if it pleaſe you, by your patience, I will ſée how I can end the queſtion, next following of 30 Buſhels of wheat ſowed, which in one yeare yéelded 360 how many then will 80 Buſhels yéeld in 7 yeare ſowing euerie yeare of thoſe 7 ſtill 80 buſhels, and accoꝛding to your reaſons I ſet my numbers thus.

| *Buſh.* | *Yeare.* | *Buſh.* | *Buſh.* | *Yeare.* |
|---|---|---|---|---|
| 30 | 1 | 360 | 80 | 7 |

80

28800

7

201600

Wher-

Where I multiply 30 by 1, and it maketh 30 my Diuiſor: then multiplying the other three numbers the one into the other, as here appeareth in my tables, they make 201600, which I diuide by 30: & my quotient is 6720 buſhels, my deſire, for ſo much alſo it came to at two workings by the Rule of three.

Maſter. Yet one queſtion more I will propound vnto you, and ſo leaue this Rule, till it pleaſe God hereafter, that I may make you worke it in broken numbers.

Queſtion of Intereſt.

*What comes the intereſt of* 258 pound, *for fiue moneths to, after the rate of* 8 pound *taken in the* 100 pound, *for* 12 *moneths?*

Scholar: Sir, this is yet within the compaſſe of ſome reaſonable diſtance. Therefore to miniſter equity in this caſe, I will ſée how I can worke the ſame, which I ſet downe thus, praying you if I haue not done wel, to ſhew me mine errour.

li *moneths.* li li *mon.*
100-12—8-258-5

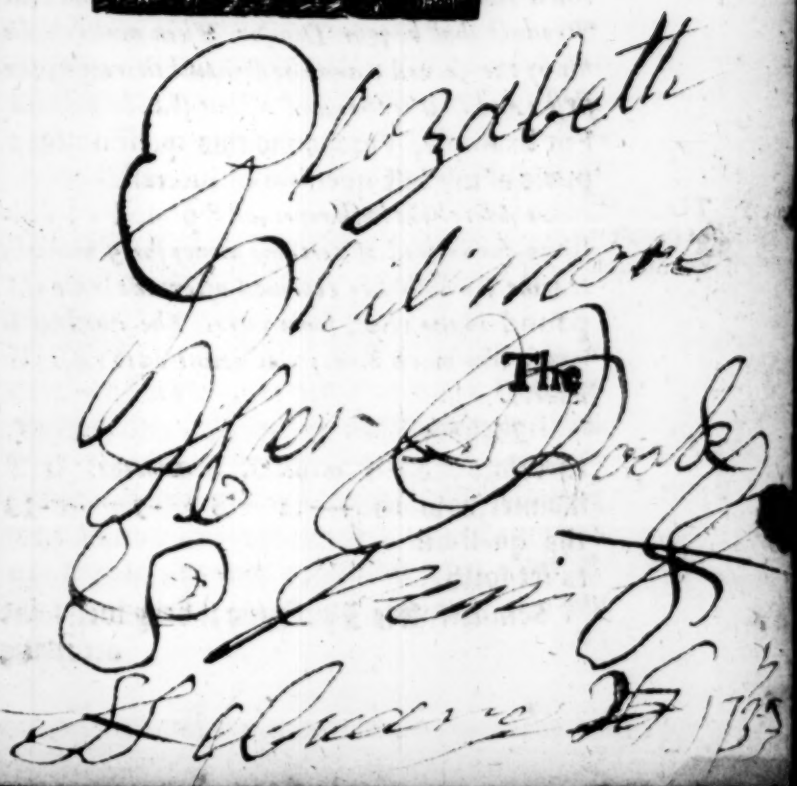
Maſter. Proceéd, you haue done very well.

Scholar. Then I doubt not by the grace of God but to end it: I multiply 100 by 12, it yéeldeth 1200, and the three other numbers multiplied together produce 10320, which I diuide by 1200: and my quotient is 8 pounds. Then according as you haue taught me heretofore, I turne the 720 pound that I left, into ſhillings: and diuiding it by the firſt number, my Quotient is 12 ſhillings,

lings. So I answer, that the loane of 258 pounds for 5 moneths, after the rate of 8 pound in the 100 pound for a yéere, comes to 8 pound 12 shillings.

Master. You say true, I commend your diligence: now behold the manner of the second part of this rule.





# The backer Rule, or the second part of the Rule of Proportion compound.

Maſter.

*IN the ſecond part of this Rule of Proportion compoſed, the third number is like vnto the firſt. And the Rule is to be wrought thus: you ſhall now, contrary to the laſt rule, multiply the third number and the fourth together, and that Product ſhall be your Diuiſor. Then multiply the fift by the ſecond, and the Product thereof by the firſt: and that is the number that ſhall be dinided.* For Example, I propound this queſtion, for a proofe of my laſt queſtion of intereſt.

The proof of the laſt queſtion.

*A Merchant hath receiued* 8 pound 12 ſhillings, *for intereſt of certaine money for* 5 *moneths tearme, which hee receiued after the rate of* 8 pound *in the* 100, *for a yeere. The queſtion is now, how much money was deliuered to raiſe this intereſt,*

Behold therefore the manner, how the queſtion is ſet forth.

li *moneths.* li *moneths.* li ſ.
100 — 12 — 8 — 5 — 8-12

Scholar. Sir I perceiue it very well: and according

according to the doctrine which you prescribed for the working thereof: if please you now it is set downe, I thinke I can follow the worke.

Master. Nay stay a while, and before you worke, marke well how I deliuer a reason for the perfect vnderstanding of this Rule, which is thus: *If* 8 pound *in* 12 *moneths doe yeeld me* 100 pound, *to take* 8 pound 12 shillings *for* 5 *moneths, must needs yeeld a great deale more*. Note.

So vpon the knowledge that I haue in this Art, the first part of this rule is answerable to the rule of three forward: and this latter part accordeth to the rule of three backward.

Scholar. Sir, I yeld you most heartie thanks for these your last instructions, they haue giuen mee great light into these two rules, whereby I may the better by deliberation conceiue how to vse them hereafter when occasion shall require.

Master. You say well, go to now if you will, and trie your cunning in the question: But this note take with you by the way, in as much as here is mention made of shillings: turne all your money as you worke into shillings for your more ease in working. Note.

Scholar. If it please you to behold me a little, I will quickly end it: for I haue but my first, my second, and my last number to be multiplied together for my diuidend: And my third

into my fourth for my Diuisor.

| li | *Moneths.* | *Moneths.* | li | ſ. |
|---|---|---|---|---|
| 100 | 12 | 8 | 5 | 8 . 12 |
| 20 | | 20 | | 20 |
| 2000 | | 160 | | 172 |
| 12 | | 5 | | |
| 4000 | | 800 | | |
| 2000 | | | | |
| 24000 | | | | |
| 172 | | | | |
| 48000 | | 4128000( | | |
| 168000 | | 8 00 | | |
| 24000 | | | | |
| 4128000 | | | | |

Which 4128000 I diuide by 800, and my Quotient is 5160 shillings, which in pounds yeeldeth 258, my desire:

Master. I will here for this time in whole numbers end this Rule, and I will instruct you in the Rules of fellowship. You may at your conuenient leasure for your exercise worke the same by the Rule of Three at twice. And for your aid and incouragement therein, I set downe heere a proffer how to apply it.

| A | | | B | |
|---|---|---|---|---|
| *Months.* | li. | s. | *Pound.* | li. |
| 5 | 8 | 12 | 8 | 100 |
| 12 | 41 | 12½ | 412½ | 258 li. |

# The Rule of Fellowship.

The Rule of Fellowship without time.

BVt now will I shew you of the Rule of Fellowship or Company, which hath sundry operations, according to the diuers number of the Company. This Rule is sometime without difference of time, and sometimes there is in it difference of time. First I will speake of that without difference of time, of which let this be an example.

A question of Company.

*Foure Merchants of one Company made a banke of money diuersly: for the first layed in* 30 pound, *the second* 50 pound, *the third* 60 pound, *and the fourth* 100 pound, *which stocke they occupy so long, till it was increased to* 3000 pound. *Now I demand of you what should each receiue at the parting of this money.*

Scholar. I perceiue that this Rule is like the other, but yet there is a difference, which I perceiue not.

Master. Then will I shew it to you. First by Addition, you shall bring all the particular summes of the Merchants into one summe, which shall be the first summe in your working by the Golden Rule, and the whole summe of the gaines by that stocke shall be the second summe. Now for the third summe you

shall set the portion of each man one after another, and then worke by the Golden Rule, and the fourth summe will shew you each mans gaines: as in example.

| | |
|---|---|
| | 30 |
| | 50 |
| | 60 |
| | 100 |
| | 240 |

The parcels of these foure Merchants make in one summe 240 pounds: set that in the first place, the gaines in the second, and the first mans portion of stocke in the third place, thus:

240 — 3000
30

Now multiply the second by the third, and it will be 90000, which you shall divide by 240, and there will appeare 375 pounds thus:

And that is the gaines for the first man.

240 — 3000
30 — 375

Now for the second man, set the 50 pound that he brought, in the third place, and worke as before: and his part will be 625 pound: as this figure sheweth.

Likewise for the third man, set his money which was 60 pounds and his part of gaines will bee 750 pounds, as heere appeareth.

240 — 3000
50 — 625

And so for the fourth man; if you set his summe which is 100 pound his gaines will bee 1250 pound, as the worke will declare.

240 — 3000
60 — 750

Scholar. This I perceiue: but is there any way to examine whether I haue well done or no?

240 — 3000
100 — 1250

Note this common proofe.

Master. For the triall hereof, adde together all their foure portions, and if their addition make the whole summe of their gaines, then is the worke well done.

Scholar. That will I try by and by, the foure parcels are these which added together make 3000, which is the iust summe of money that they gained, whereby I know the worke is well done.

375
625
750
1250
3000

Master. Well, now another example will I put to you, not of gaines, but of losse: for one reason serueth for both.

A question of losse.

*If three Merchants in one ship, and of one fellowship, had bought Merchandise, so that the first had laid out* 200 pound, *the second* 300 *pound, the third* 500 *pound, and it chanced by tempest that they did cast ouer board into the Sea Merchandise of the value of* 100 pound, *how much should each man beare in this losse?*

Scholar:

Scholar. If I shall doe in this, as you did in the other question, then must I ioyne their three portions together 200, 300, 500, which maketh 1000. Then say I, if 1000 lose 100 then shall 200 lose 20, and 300 shall lose 30, and 500, shall lose 50, as by the three figures it doth appeare plaine.

1000 — 100 | 1000 — 100
200 — 20 | 300 — 30
1000 — 100
500 — 50

Master. Well sith now you haue done these, I will propound a question of more importance, which shall make you not only the abler to vnderstand this Rule, but also it will greatly aid you in the next Rule of Fellowship with time, if such need be that your mony be of diuers denominations.

For this may not be forgotten in all such questions: if the number be of diuers kinds, you must by Reduction bring it into one kind that is to say, to the least value that is named in the question. And likewise shall you doe, if the time be of diuers kinds, as some yeeres, some moneths, weekes, and dayes, you shall make all moneths, weekes or dayes, according as the least name of time in the question is, as for example.

A question of sheepe.

*First in diuersity of mony. Three companions bought* 2000 *sheep & paid for them* 241 pound 13--4 *pence, of which summe one paide* 101

pound, 10 ſhillings. *The ſecond* 82 pound, 17 ſhillings, 10 pence. *And the third payed* 57 pound 5 ſhillings 6 pence, *How many ſheepe muſt each of them haue?* Anſwer: *The firſt ſhall haue* 840. *The ſecond* 686. *And the third* 474. *And that muſt you worke thus.*

Solution. First, conſidering that your money is of diuers denominations, you ſhall (by Reduction) bring it all into the ſmalleſt denomination which is in it, that is to ſay, pence, and ſo will the totall ſumme be 58000 pence.

Now if you turne each mans money into pence alſo, the firſt mans ſumme will be 24360 pence: The ſecond mans money will be 13746 pence.

Now to know how many ſheepe euery man ſhall haue, let the whole ſumme of money, that is, 58000 pence be ſet in the firſt place, and in the ſecond place ſet the number of ſheepe, and then orderly in the third place ſet each mans money, and then multiplying the third and the ſecond ſummes together, and diuiding that that amounteth by the firſt, there will appeare the number of ſheepe that each man ought to haue: as theſe three figures do ſhew.

| a | | b | |
|---|---|---|---|
| 58000 | 2000 | 58000 | 2000 |
| 24360 | 840 | 19894 | 686 |

c

58000 — 2000
13746 — 474

Schor. Why do you set the money in the first place, seeing in the question you say 2000 sheepe cost 58000 pence, and not thus: 58000 cost 2000 sheepe.

Master. You remember I taught you at the beginning of the Golden Rule, that the first and third numbers must be of one name, and of like things: and euermore the number that the question is asked of must be set in the third place.

Now is the question plainly this: If foure men bought 2000 sheepe for 58000 pence, how many sheepe shall each man haue?

But seeing in this question, there ought more respect to be had to the summe of money then to the summe of the persons, (for in the summe of money is their proportion toward the sheepe, and not in the number of persons.) *If* 58000 *pence bought* 2000 *sheepe, how many did* 24360 *buy? Againe, how many did* 19894 *pence buy? And how many bought* 13746 *pence?*

Scholar. I perceiue it reasonably, and so shall

shall I doe in all questions.

Master. Even so. But for easinesse of the worke, marke this: When soeuer the first and second numbers haue cyphers in the first places, you may both in the Multiplication and in the Diuision leaue out those cyphers, so that you leaue out like many out of both summes, as in this question, the first number 58000 hath three cyphers, and so hath the second, that is 2000: therefore cast away their cyphers, and so will the first number be 58, and the second 2: set them in their places, and worke according to the Rule, and you shall perceiue that will be all one, hauing that this is the shorter & easier way, as these three figures doe shew.

Note.

a

58 × 2

24360 — 840

b

58 × 2

19894 — 686

c

58 / 2

13946 — 474

And this you see is both easier, and also the more certaine way to know the answer to this question.

Scholar. Truth it is as you say: but sir me seemeth I might aske a further question here, not onely how many sheepe each man should haue, but also what euery sheepe cost.

Master. That question doth not onely belong

long to this Rule, but may also be discussed by Division, especially if the questions number be one onely, as thus: Diuide the totall summe 58000 pence by 2000 (or 58 by 2, omitting the cyphers, and the quotient will be 29 pence that is 2 shillings 5 pence. Howbeit, by this Rule you may do it, and best when the number of the question doth exceed 1; as if I should aske this question.




2000 sheepe cost 58000 pence, how much doe 20 cost? Then shall I set my figure as before.

And doing after the Rule, there will amount 580 pence, that is, 2 pound 8 shilling 4 pence the price of one score: but if you will vse that easie way that I did teach you now, you may change the first and second number thus.




Thus do you perceiue the vse of the Rule without Time.

Scholar. All this I vnderstand very well: I pray you now instruct me in the Rule of Fellowship with time.

The

# The Rule of Fellowship with time.

Maſter.

The Rule of Fellowſhip with time.

TO the intent you may as well perceiue the ſame Rule with diuerſity of time, I propoſe this example.

*Foure Merchants made a common ſtocke, which at the yeares end was increaſed to 35145 pound. Now to know what ſhall be each mans portion of gaine, you muſt know each mans ſtocke, and time of continuance.*

Queſtion of a bank.

The firſt man of theſe foure laid in 669, which he did take from the ſtocke againe at the end of 10 moneths. The ſecond man laid in 810 pound, for eight moneths. The third laid in 900 pound, for ſeuen moneths. And the fourth layed in 1040 pound, for 12 moneths.

Note. A generall Rule.

This queſtion ſhall you examine as you did the other before, ſauing that whereas in the third place of the figure you did ſet each mans ſumme alone, heere you ſhall ſet the ſame being multiplied by the number of their time: and likewiſe in the firſt place of the figure you ſhall ſet the number which amounteth of their whole ſummes ſo multiplied by their time, and added into one whole

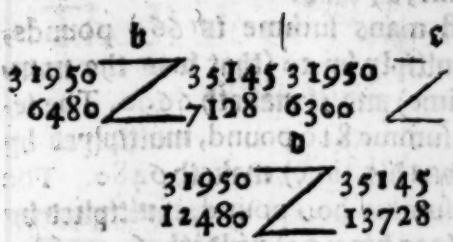
whole ſumme, as thus.

The firſt mans ſumme is 669 pounds, which I multiply by 10 (that was the nomber of his time) and it maketh 6690. The ſecond mans ſumme 810 pound, multiplyed by 8 (which was his time) maketh 6480. The third mans ſumme 900 pound, multiplied by 7 (for that was his time) yeldeth 6300. The fourth mans ſumme was 1040 pound, and his time 12: multiply the one by the other, and it will be 12480.

The foure ſummes thus multiplied by their time, muſt be ſet orderly in the third place of the figure, and in the firſt place muſt be ſet the whole ſumme of all foure, which is 31950; and the gaine muſt be in the ſecond place, which is 35145. Now to end the queſtion, I ſay firſt, If 31950 did get 35145, what did 6690 get? Anſwer, 7359 pounds, as by this figure appeareth.

| | | |
|---|---|---|
| 31950 | a | 35145 |
| 6690 | | 7359 |

Likewiſe, the ſecond man had to his part 7128 pound, the third muſt haue 6930 pounds, and the fourth man ſhall haue for his part 13728 pound, as theſe figures do partly declare.




Scholar. This I like very well: but what proofe is there of this worke?

Another proofe.

Master. The same that I taught you for the other: howbeit, there is used both for this worke and the other also, this manner of proofe, to adde all the portions together, and it may agree to the whole summe, then seemeth your worke well done: but this is no sure proofe.

Scholar. Yet will I prone in this example: The foure parcels are these, which if I adde together, there will amount 35145, and that was the whole summe, whereby I perceiue the worke is well done.

| | |
|---|---|
| | 7359 |
| | 7128 |
| | 6930 |
| | 13728 |
| | 35145 |

Master. If it fall out otherwise, be sure it is not well.

Scholar. Then do I vnderstand this worke also very well: but what haue I now to learne?

Master. There are many other excellent parts

parts behind, of which I will not as now make mention, because that without the knowledge of fracticns they cannot be duely taught, and much lesse understood. Therefore will I propose to you two or three questions more, (that thereby you may better perceive the use of this Rule and all other the like) and so make an end for this time,

¶ *Three partners, by some ill adventure sustained the losse of* 160 pound, *whereof the first laid into the common stocke* 200 pound, *for ten moneths. The second laid in* 350 pounds, *and the third* 100 pound, *but for how long the two latter, is unknowne. But breaking off their partnership, the first found himselfe a loser* 80 pound, *the second* 56 pound, *and the third* 24 pound. *The question is for how long time was the money of the two latter in company* A question of losse.

For the solution hereof, and of such other like, you must also multiply the first mans 200 pound, that he put into the stocke by his time of continuance, which was 10 moneths, and it maketh 2000: wherefore now I affirme, if his mony that lost 80 pound, multiplied by his time make 2000: what shall his mony make that lost 56 pound, and his that lost 24 pound, which two numbers I commit to the triall of the rule of Three, at two workings thus:

If 80 give 2000, what giveth 56? And againe, if 80 give 2000, what giveth 24?

80 / 2000 80 / 2000
56 / 1400 24 / 600

To conclude, if you now diuide 1400, the second mans portion by 350, which was his stocke that he laid into Company, you shall finde in your quotient 4 moneths, and for so long time did the second man put his money into the common stocke.

Lastly, if you diuide the third mans new laying in, which was 600 by 100, which was his stocke that he put into Company: the Quotient declareth his time of continuance, which was 6 moneths. And thus is the question resolued.

Scholar. Sir, I haue attentiuely beheld your working, and the more we trauell herein, the more me thinke I am in loue with this excellent Art.

Master. Then what say you to this Question?

A question of Canon

*There is in a Cathedrall Church* 20 *Canons, and* 30 *Vicars, those may spend by yeare* 2600 pound, *but euery Canon must haue to his part fiue times so much as euery Vicar hath: how much is euery mans portion, say you?*

Scholar. I pray you make the answer your selfe also, so shall I perceiue best the meanes to answer to such other like.

Master. In this question, you must doe as in those beforesaid, that haue diuersity of time,

time, for here is diuersity of portions. Therfore shall you multiply the number of the persons by their difference of portion: (as you did in the other by time:) Then must you multiply the 20, (which is the number of Canons) by 5, (for that is the number of their portion) so will it be 100. Then 30, that is the number of Vicars) by 1, (that is the number of their portion) and it will be 30: put those two sums together, and they make 130. Then say thus: If 130 spend 2600 pounds, what may 100 spend? The Rule sheweth 1000 pounds.

Againe for Vicars: If 130 spend 2600 pound, what may 30 spend? Answer, 600 pound, as these figures shew.



| | | | |
|---|---|---|---|
| 130 | 2600 | 130 | 2600 |
| 100 | 2000 | 30 | 600 |

But if euery Canon should haue so oftentimes 4 pound, as the Vicar should haue 3 pound, then should I multiply 20 by 4, (that were 80) and 30 by 3, (that were 90) and then both were 170. Then should the figures be set as followeth.

| li | s | d | li | s | d |
|---|---|---|---|---|---|
| 170 | 2600 | | 270 | 26000 | |
| 80 | 1223 | 10,7 | 90 | 1376 | 9.5 |

But this sort is too hard for you, by rea-

ſon of the fractions, therefore I will let it reſt to that place.

And by this rule you ſée what the 20 Canons may ſpend, which ſumme if you diuide by 20, you ſhall ſée each Canons portion: and ſo of the Vicars, if you diuide their ſumme by 30, the quotient will declare euery Vicars portion.

The

# The second Dialogue.

## The accounting by Counters.

Master.



*NOw that you haue learned the common kinde of Arithmeticke with the pen, you shall see the same Art in* Counters: *which feat doth not onely serue for them that cannot write and reade, but also for them that can doe both, but haue not at sometime their pen or tables ready with them.*

This sort is in two formes commonly. The one by lines, and the other without lines. In that that hath lines, the lines do stand for the order of places: and in that that hath no lines, there must be set in their stead so many Counters as shall need for each line one; and they shall supply the stead of lines.

Scholar. By examples I should better perceiue your meaning.

Master. For example of the lines, loe here you see six lines, which stand for six places, so that the

100000
10000
1000
100
10
1

Numeration by Counters.

nethermost standeth for the first place, and the next above it for the second, and so vpward till you come to the highest, which is the sixth line, and standeth for the sixth place.

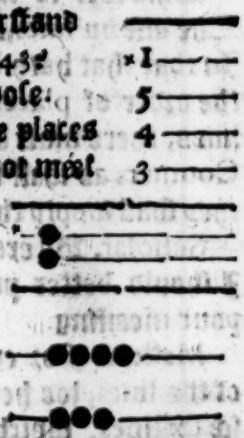
Now what is the value of euery place or line you may perceiue by the figure which I haue set on them, which is according as you learned before in Numeration of figures by the pen: for the first place is the place of vnites or ones, and euery counter set in that line, betokeneth but one: and the second line is the place of 10, for euery counter there standeth for 10: the third line the place of hundreds, the fourth of thousands, and so forth.

Scholar. Sir, I do perceiue that the same order is here of lines, as was in the other figures by places, so that you shall not need longer to stand about Numeration, except there be any other difference.

Master. If you do vnderstand it then how will you set 1543?

Scholar. Thus as I suppose.

Master. You haue set the places truly, but your figures be not meet for this vse: for the meetest Figures in this behalfe, is the Figure of a counter round, as you see here, where I haue expressed that same summe.

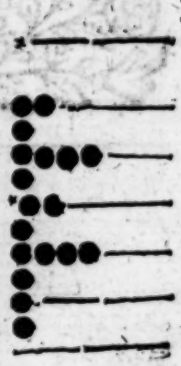



Scholar. So that you haue not one Figure for

for 2, nor 3, nor 4, and so forth, but as many Digits as you haue, so many Counters you set in the lowest line, and for euery 10 you set one in the second line, and so of other. But I know not by what reason you set that one Counter for 500 betweene two lines.

Master. You shall remember this, that whensoeuer you need to set downe 5, 50, or 500, or 5000, or set forth any number whose Numerator is 5, you shall set one counter for it in the next place aboue the line that it hath his denomination of: as in this example of that 500, because the numerator is 5, it must be set in a void space, and because the denomination is a hundred, I know that his place is the void place next aboue hundreds, that is to say, aboue the third line.

And further you shall marke, that in all working by this sort, if you shall set downe any summe betweene 4 and 10, for the first part of that number you shall set downe 5, and then so many counters more, as there rest numbers aboue 5. And this is true both of Digits and Articles. And for example, I will set downe this summe 297965, which summe if you marke well, you need none other examples for to learne the numeration of this forme.



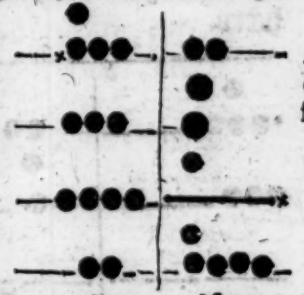
But this shall you marke, that as you did in other kindes of Arithmeticke, set a pricke in the places of thousands, in this worke you shall set a Starre, as you see before.

Scholar. Then I perceiue Numeration: But I pray you how shall I doe in this Art to adde two summes or more together.

# Addition.

Maſter.

*THe eaſieſt way in this is to adde but two ſummes at once together: Howbeit you may adde more, as I will tell you anon.* Therefore when you will adde two ſummes you ſhall firſt ſet downe one of them, it forceth not which, and then by it draw a line croſſe the other lines. And afterward ſet downe the other ſumme, ſo that the line may bee betweene them: as if you would adde 2659 to 8342, you ſet your ſummes as you ſée héere.



Addition of two ſummes.

And then if you liſt, you may then adde the one to the other in the ſame place: or elſe you may adde them both together in a new place: which way, becauſe it is moſt plaine, I will ſhew you firſt.

Therefore will I beginne at the vnites, which in the firſt ſumme is but 2, and in the ſecond ſumme 9, that maketh 11. Thoſe doe I take vp, and for them I ſet 11 in the new roome, thus.

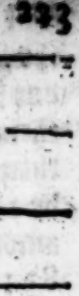


Then doe I take vp all the Articles vnder a hundred, which in the first summe are 40, and in the second summe 50, that maketh 90: or you may say better, that in the first summe there are foure Articles of 10, and the second summe 5, which maketh 9, but then take héed that you set them in their right lines, sée héere.



Where I haue taken away 40 from the first summe, and 50 from the second, and in their stead I haue set 90 in the third roome, which I haue set plainly, that you might well

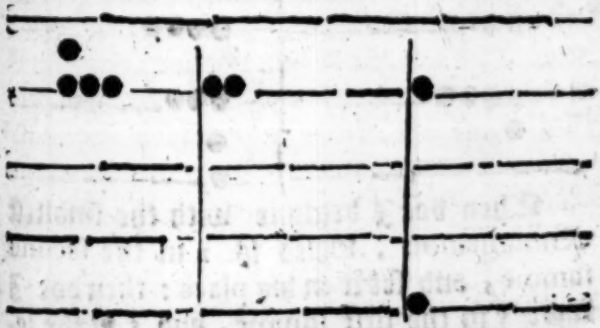
well perceiue: howbeit, seeing that 90 with the 10 that was in the third roome already, doth make 100, I might better for those 6 Counters set 1 in the third line thus:



For it is al in one summe, as you may see, but it is best neuer to set fiue Counters in any line, for that may be done with one Counter in a higher place.

Scholar. I iudge that good reason, for many are vnnedfull where one will serue.

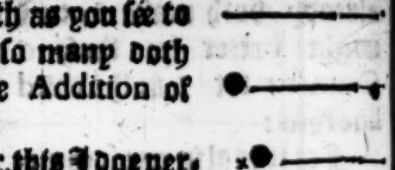
Master. Well, then will I adde forth of hundreds: I finde 3 in the first summe, and 6 in the second, which maketh 900, them do I take vp, and set in the third roome, where is 100 already, to which I put 900, and it will be 1000: therefore I set one Counter in the fourth line for them all, as you see here.



Then adde I the thousands together, which in the first summe are 8000, and in the

the ſecond 2000, that maketh 10000: then doe I take vp for theſe two places, and for them I ſet one Counter in the fifte line, and then it appeareth as you ſée to be 11001, for ſo many doth amount of the Addition of 8342 to 2659.

To adde ſummes togeather.



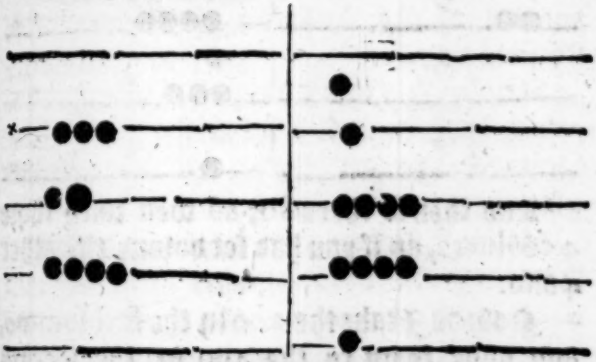
Scholar. Sir, this I doe perceiue: but how ſhall I ſet one ſumme to another, not changing them to a third place.

Maſter. Marke well how I do it: I will adde togeather 6 5 4 3 6 and 3 2 4 5, which firſt I ſet downe thus:

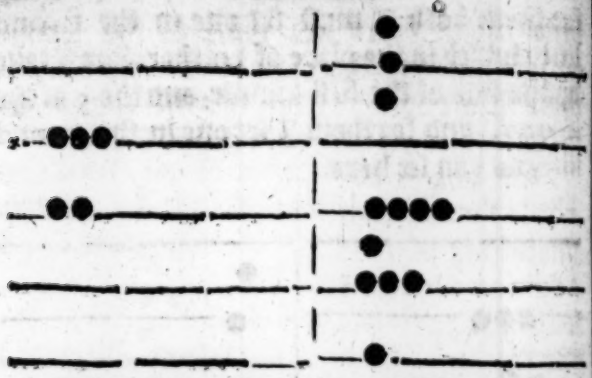


Then doe I beginne with the ſmalleſt denomination, which is 1 in the ſecond ſumme, and ſet it in his place: then doe I finde 5 in the firſt ſumme, and 5 in the ſecond, which put togeather, ſauing the two counters cannot be ſet in a voyd place of 5, but for

for them both I must set one in the second line, which is the place of 10. therefore I take vp the fiue of the first summe, and the 5 of the second, and for them I set one in the second line, as you see here.

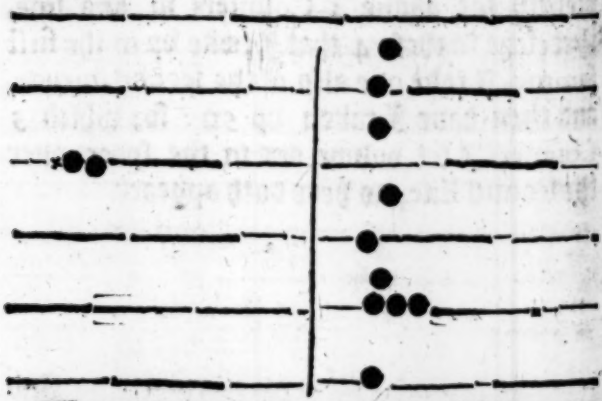


Then doe I likewise take the 4 Counters of the first summe and second line, (which maketh 40) and adde them to the 4 Counters of the same line in the second summe, and it maketh 80: but as I said, I may not conueniently set aboue 4 Counters in one line, therefore to those 4 that I toke vp in the first summe, I take one also of the second summe, and then haue I taken vp 50: for which 5 Counters I set downe one in the space ouer the second line, as here doth appeare.



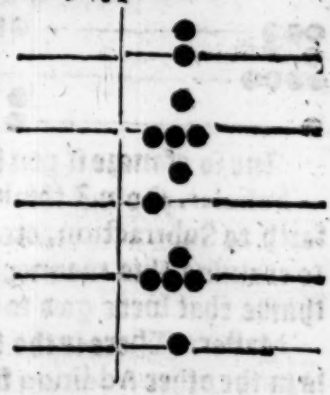
And then is there 80, as well with thoſe 4 counters, as if you had ſet downe the other 4 alſo.

Now do I take the 200 in the firſt ſumme, and adde them to the 400 in the ſecond ſumme, and it maketh 600, therefore I take vp the two counters in the firſt ſumme, and three of them in the ſecond ſumme, and for them 5, I ſet 1 in the ſpace aboue, thus:



Then take I the 3000 in the firſt ſumme, vnto

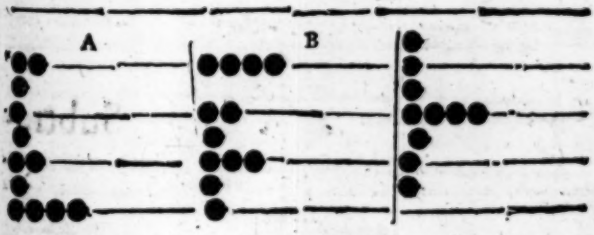
vnto which there are none in the second ſumme agréeing, therefore I do onely remoue thoſe thréé counters from the firſt ſumme into the ſecond, as here doth appeare.



And you ſée the whole ſumme that amounteth of that Addition of 65436 with 3245, to bée 68681.

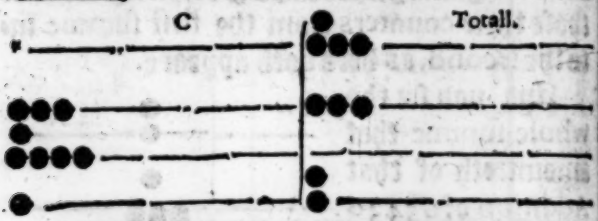
And if you haue marked theſe two examples well, you néed no further inſtruction in Addition of 2 onely ſummes: but if you haue more then two ſummes to adde, you may adde them thus:

Firſt adde two of them, and then adde the third and fourth, or more, if there bée ſo many: as if I would adde 2679, with 4286, and 1391. Firſt I adde the two firſt ſummes thus:




And

And then I adde the third thereto, thus.




And so of more if you haue them.

Scholar. Now I think it best that you passe forth to Subtraction, except there be any way to examine this manner of Addition, then I thinke that were good to be knowne next.

Master. There is the same proofe here that is in the other Addition by the pen, I meane Subtraction; for that onely is a sure way, but considering that Subtraction must be first knowne, I will first teach you the Art of Subtraction, and that by this example.

Subtra-

# Subtraction.

*I Would Subtract* 2 8 9 2 *out of* 8 7 4 6. *These ſummes muſt I ſet downe as I did in Addition: but heere it is beſt to ſet the leſſer number firſt, thus:*



Then ſhal I begin to Subtract the greateſt numbers firſt (contrary to the vſe of the pen) that is the thouſand in this example: therefore I find amongſt the thouſands 2, for which I withdraw ſo many from the ſecond ſumme (where are 8) and ſo remaineth there 6, as this example ſheweth.



Then

Then do I likewise with the hundreds, of which in the first summe I finde 8, and in the second summe but 7, out of which I cannot take 8, therefore this must I doe: I must loke how much my summe differeth from 10, which I find here to be 2, then must I abate for my summe of 800, one thousand and set downe the excesse of hundreds, that is to say, 2, for so much as 1000 is more then I should take vp: therefore from the first summe I take that 800. and from the second summe (which are 6000) I take vp one thousand, and leane 5000, but then I set downe the 200 vnto the 700 that are there already, and make them 900, thus.



Then come I to the Articles of tennes, where in the first summe I finde 90, and in the second summe but onely 40. Now considering that 90 cannot be abated from 40, I loke how much that 90 doth differ from the next sum aboue it, that is, 100 (or else which is all to one effect) I loke how much 9 doth differ from 10, and I finde it to be 1: then in the stead of that 90, I doe take from the se-

cond

cond ſumme 100: but conſidering that is 10 to much, I ſet downe 1 in the next line beneath for it, as you ſee here.



Sauing that here I haue ſet 1 Counter in the ſpace in ſtead of 5 in the next line.

And thus haue I ſubtracted all ſaue 2, which I muſt abate from 6 in the ſecond ſumme, and there wil remaine 4, thus:



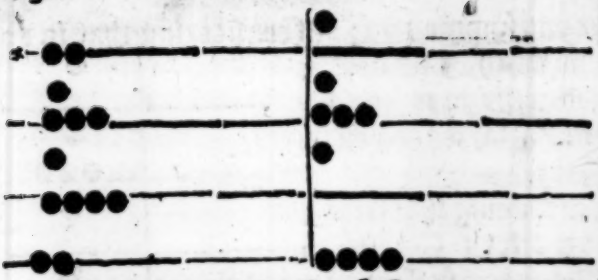
So that if I ſubtract 2892 from 8746 the remainer will bee 5854.



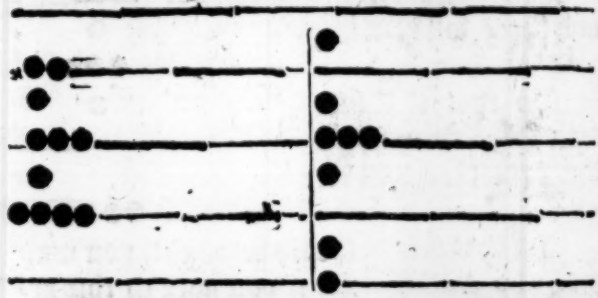
And that this is truely wrought, you may proue by Addition: for if you adde to this remainer the ſame ſumme that you did ſubtract then will the former ſumme 8746 amount againe.

Scholar. That will I proue, and firſt I ſet the ſumme that was ſubtracted, which was 2892, and then the remainer 5854, thus:

A proofe of Subtraction.

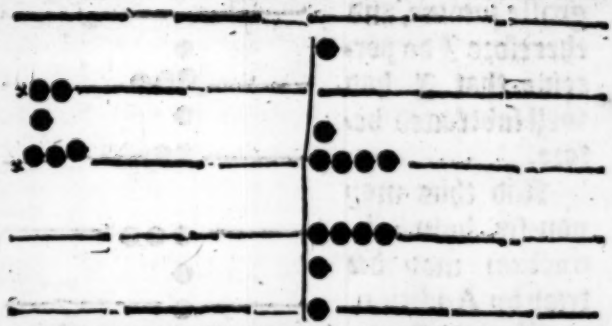


Then doe I adde the first 2 to 4, which maketh 6: so take I vp 5 of those Counters, and in their stead I set 1 in the space: and one in the lowest line, as here appeareth.

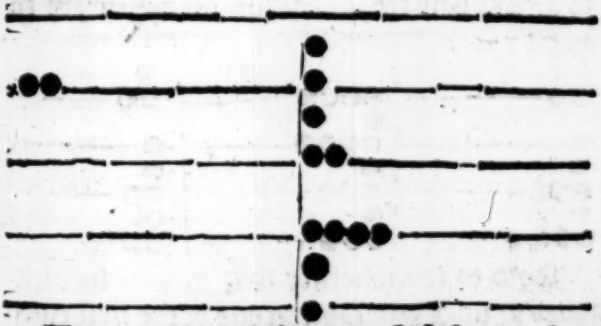


Then do I adde the 90 next aboue to the 50, and it maketh 140, therefore I take vp those 6 counters, and for them I set 1 to the hundreds in the third line, and 4 in the second line thus:

Then

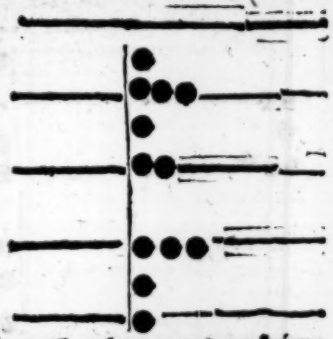


Then doe I come to the hundreds, of which I finde 8 in the first ſumme, and 8 in the ſecond, that maketh 1600, therefore I take vp thoſe 8 counters, and in their ſtead I ſet 1 in the fourth line, and 1 in the ſpace next beneath, and in the third line, as you may ſée héere.



Then is there left in the firſt ſumme but onely 2000, and in the ſecond 5000, which is 7000, which I ſhall take vp from thence, and ſet in the ſame line in the ſecond ſumme to the one that is there already: and there will the whole ſumme appeare as you may well ſée, to be 8746, which was the firſt

groſſe ſumme, and therefore I do perceiue that I had well ſubtracted before.



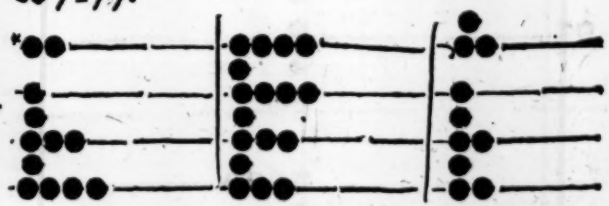
And thus may you ſée, how Subtraction may bée tried by Addition.

Scholar. I perceiue the ſame order héere with counters, that I learned before in figures.

Maſter. Then let me ſee how you can try Addition by Subtraction.

Scholar. Firſt I will ſet forth this example of Addition, where I haue added 2189, to 4988. And the whole ſumme appeareth to be 7177.

Proofe of Addition by ſubtraction.

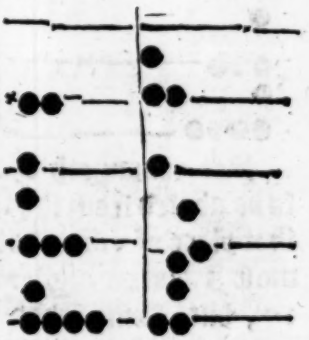


Now to try whether that ſumme be well added or no, I will ſubtract one of the firſt two ſummes from the third. And if I haue well done, the remainer will bée like that other ſumme: as for example, I will ſubtract the firſt ſumme from the third, which I ſet thus in order.

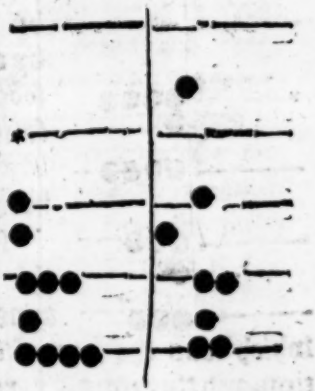
Then



Then do I ſubtract 2000 of the firſt ſumme, from the ſecond ſumme, and then remaineth there 5000, thus:

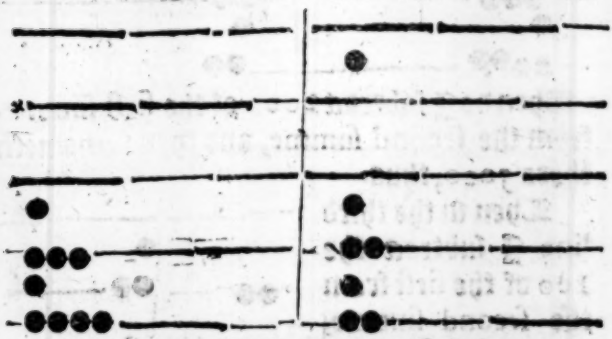


Then in the third line I ſubtract the 100 of the firſt from the ſecond ſumme, where is onely 100 alſo: and then in the third line, reſteth nothing, as you may ſée in this example followyng.

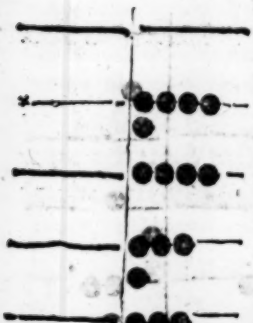


Then in the ſecond line with his ſpace ouer him I finde 80, which I ſhould ſubtract from the other ſumme: then ſéeing there are but onely 70, I muſt take it out of ſome higher ſumme, which is here onely 5000:

therefore I take vp 5000: and seeing that is too much by 4920, I set down so many in the second roome; which with the 70 being there already, do make 4990, and then the summes do stand thus.



Yet remaineth therein the first summe 9, to be abated from the second summe, wherein that place of vnites doth appeare onely 7: then must I abate a higher summe, that is to say 10, but seeing that 10 is more then 9, (which I should abate) by 1, therefore shall I take vp one Counter from the second, and set downe the same in the first line, or lowermost line, as you see here.

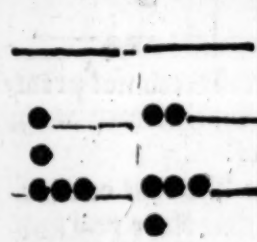


And so haue I ended this worke, and the summe appeareth to be the same which was the second summe of mine Addition, and therefore I perceiue I haue well done.

Master.

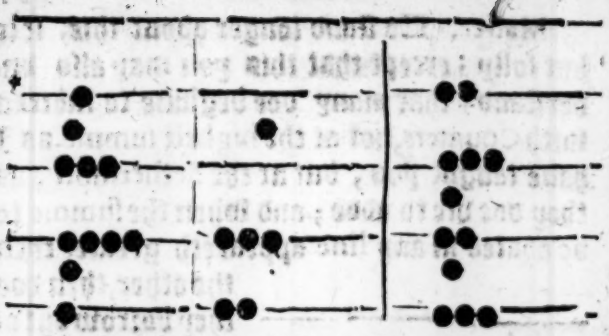
Another way of Addition.

Maſter. To ſtand longer about this, it is but folly: except that this you may alſo vnderſtand, that many doe beginne to ſubtract with Counters, not at the higheſt ſumme, as I haue taught you, but at the nethermoſt, as they doe vſe to adde; and when the ſumme to be abated in any line appeareth greater then the other, then doe they borrow out of the next higher roome, as for exãple.



I ſhould abate 1846 from 2378, they ſet the ſummes thus:

First they tak 6 which is the lower line, and his ſpace from 8 in the ſame roomes in the ſecond ſumme, and yet there remaineth two Counters in the loweſt line. Then in the ſecond line muſt 4 be ſubtracted from 7, and ſo remaineth there 3. Then 800 in the third line, & his ſpace, from 300 of the ſecond ſumme cannot be, therefore do they abate it from a higher roome, that is, from 1000, & becauſe 1000 is too much by 200 therefore muſt I ſet downe 200 in the third line, after I haue taken vp 1000 from the fourth line. Then is there yet 1000 in the fourth line of the firſt ſumme, which if I withdraw from the ſecond ſumme, then doe all Figures ſtand in order, thus: 532.



So that (as you see) it differeth not greatly whether you beginne Subtraction at the higher lines, or at the lower.

Howbeit, as some men like that one way best, so some like the other: therefore you now knowing both, may vse which you list.

## Multiplication.

# Multiplication.

*BVt now touching Multiplication: you ſhall ſet your numbers into two roomes (as you did in thoſe other kindes) but ſo that the multiplier be ſet in the firſt roome: then ſhall you begin with the higheſt numbers of the ſecond roome, and multiply them firſt after this ſort.*

Take the ouermoſt line in your firſt working as it were the loweſt line, ſetting on it ſome moueable marke (as you liſt) and loke how many Counters bee in him, take them vp, and for them let downe the whole multiplier ſo many times as you tooke vp counters: reckoning (I ſay) that line for the vnites. And when you haue done with the higheſt number, then come to the next line beneath, and doe ſo euen with it, and ſo with the next, till you haue done all. And if there bee any number in a ſpace, then for it ſhall you take the Multiplier 5 times: and then muſt you reckon that line for the Vnites, which is next beneath that ſpace. Or elſe after a ſhorter way, yée ſhall take onely halfe the multiplier, but then ſhall you take the line next aboue the ſpace for the line of vnites. But in each working, if by chance your multiplier bee an odde number, ſo that you

you cannot take the halfe of it iuſtly, then muſt you take the greater halfe, and ſet downe that, as if that it were the iuſt halfe: and further, you ſhall ſet one Counter in the ſpace betweene that line, which you reckon for the line of vnites, or elſe onely remoue forward the ſame that is to be multiplied.

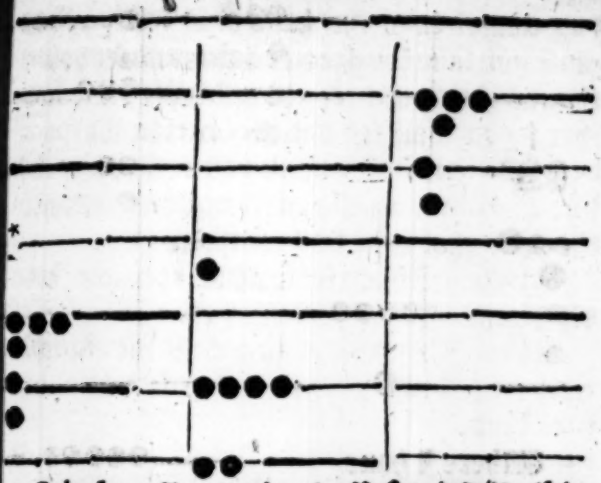
Scholar. If you ſet forth an example hereof, I thinke I ſhall perceiue you.

Maſter. Take this example: I would multiply 1542 by 365, therefore I ſet my numbers thus.



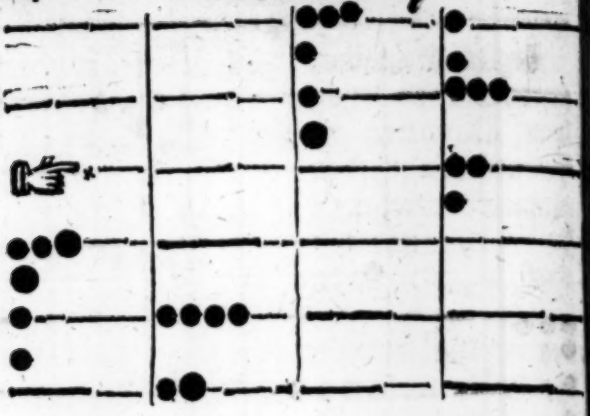
Then firſt I begin at the 1000 in the higheſt roome, as if it were the firſt place, and I take it vp ſetting downe for it ſo often (that is once) the Multiplier, which is 365, thus as you ſée here: where, for the one Counter taken vp from the fourth line, I haue ſet downe other fiue which make the ſumme of the multiplier, reckoning the fourth line, as if it were the firſt, which thing I haue marked by the ſtarre ſet at the beginning.

Scholar.



Scholar. I perceiue well, for indeed this ſumme that you ſet downe, is 365000: for ſo much doth amount of 1000, multiplied by 365.

Maſter. Well then go forth, in the next ſpace I find one Counter, which I remoue forward, but take it not vp, but (as in ſuch a caſe I muſt) ſet downe the greater halfe of my multiplier (ſeeing it is an odde number) which is 182, and here I doe ſtill let that fourth place ſtand as if it were the firſt, as in theſe examples you ſhall ſée.

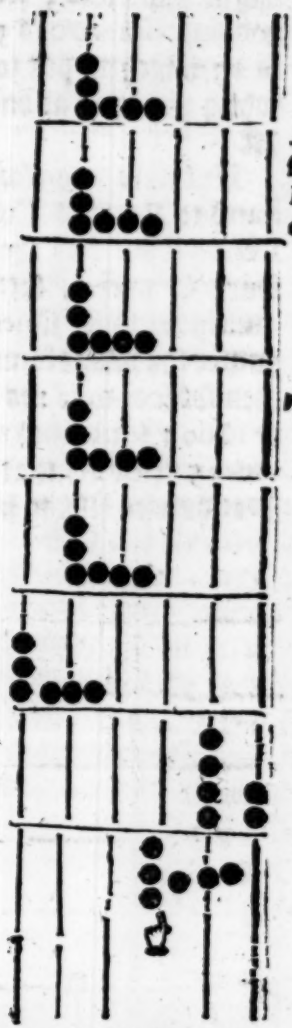


Where I haue set the Multiplicatiõ with other; but for the ease of your vnderstanding, I haue set a little line betweẽ thẽ. Now should they both in one summe stand thus.



Now

Howbeit another forme to multiply such Counters in space, is this: first to remoue the finger to the next line beneath the space, and then to take vp the counter, and to set downe the Multiplier fiue times, as heere you see.



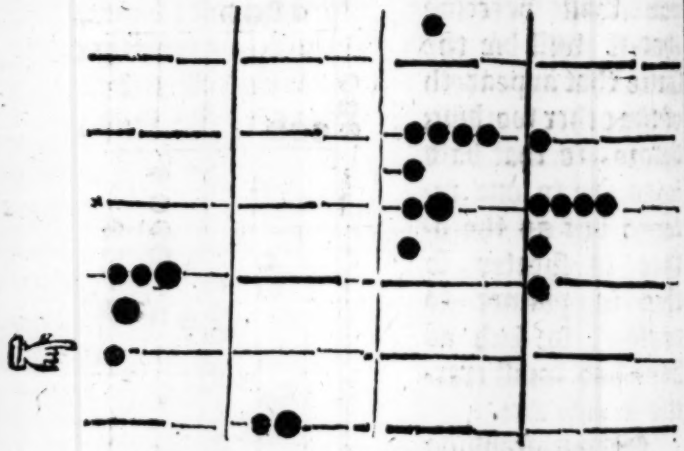
Another forme of Multiplication.

Which summes if you doe adde together into one summe you shall perceiue that it will bee the same that appeareth of the other working before, so that both sorts are to one intent: but as the other is shorter, so this is plainer to reason, for such as haue had small exercise in this Art.

Notwithstanding you may adde them in your minds before you set them downe: as in this example you might

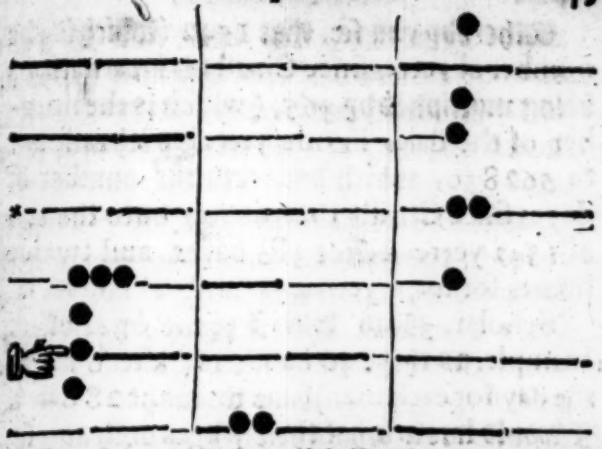
might haue said, fiue times 300 is 1500, and fiue times 60 is 300, also fiue times fiue is 25, which all put together, doe make 1825, which you may at one time set downe if you list.

But now to go forth, I must remoue the hand to the next Counters which are in the second line, and there must I take vp those foure Counters, setting downe for them my multiplier foure times seuerally, or else I may gather the whole summe in my mind first, and then set it downe: as to say, foure times 300 is 1200: foure times 60 are 240: and foure times 5 make 20, that is in all 1460: that shall I set downe also, as here you see.

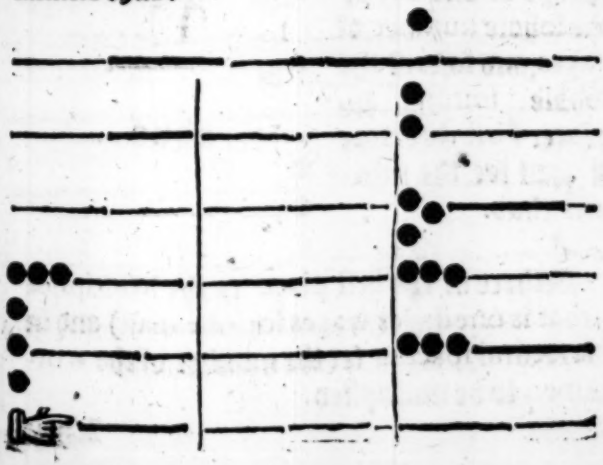


Which if I ioyne in one summe with the former numbers, it will appeare thus.

Then



Then to end this Multiplication, I remoue the finger to the lowest line where are onely 2, them doe I take vp, and in their stead doe I set downe twice 365, that is 730, for which I set one in the space aboue the third line for 500, and 2 more in the third line with that one that is there already, and the rest in their order, and so haue I well ended the whole summe thus:



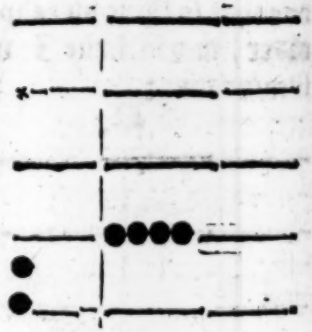
Whereby you ſée, that 1542 (which is the number of yeeres ſince Chriſt his incarnation) being multiplied by 365, (which is the number of the daies in one yeere) doth amount to 562830, which declareth the number of dayes ſince Chriſts Incarnation vnto the end of 1542 yeeres, beſide 385 dayes, and twelue houres for leape yeeres.

Example of wages.

Scholar. Now will I proue by another example, as this: 40 Laborers (after 6 pence the day for each man) haue wrought 28 daies, I would know what their wages doth amoũt vnto.

In this caſe muſt I worke doubly: firſt I muſt multiply the number of the Laborers, by the wages of a man for one day, ſo will the charge of euery day amount.

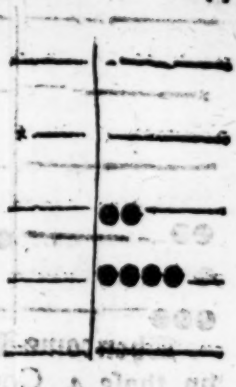
Then ſecondly ſhall I multiply the charge of one day by the whole number of dayes, and ſo will the whole ſumme appeare: Firſt therefore I ſhall ſet the ſummes thus.



Where in the firſt place is the Multiplier (that is one dayes wages for one man) and in the ſecond ſpace is ſet the number of the workemen to be multiplied.

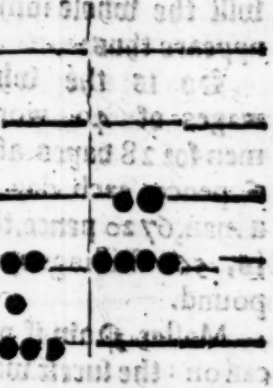
Then

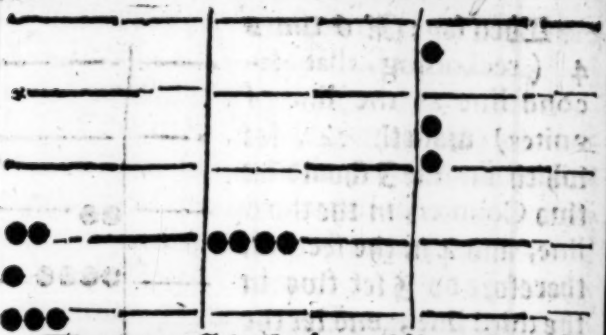
Then say: If 6 times 4 (reckoning that second line as the line of vnites) maketh 24, for which summe I should set two Counters in the third line, and 4 in the second, therefore do I set two in the third line, and let the foure stand still in the second line thus.



So appeareth the whole dayes wages to be 240 pence, that is 20 shillings.

Then do I multiply againe the same summe by the number of dayes, and first I set the numbers thus: then because there are Counters in diuers lines, I shal begin with the highest, and take them vp, setting for them the Multiplier so many times as I take vp Counters, that is twice, then will the summe stand thus.





Then come I to the second line, and take vp those 4 Counters, setting for them the multiplier 4 times, so will the whole summe appeare thus:

So is the whole wages of 40 workemen for 28 dayes after 6 pence each day for a man, 6720 pence, that is, 560 shillings or 28 pound.

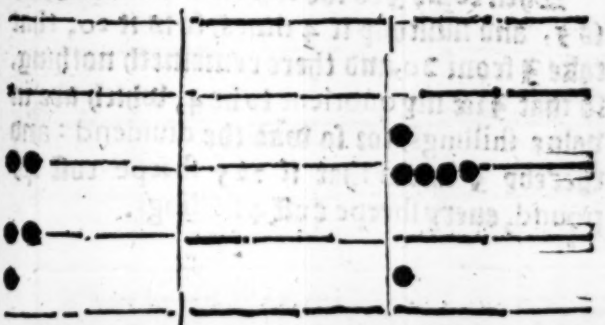
Master. Now if you would proue Multiplication: the surest way is by Diuision: therefore will I ouerpasse it till I haue taught you the Art of Diuision, which you shall worke thus.

Diuision.

# Diuision.

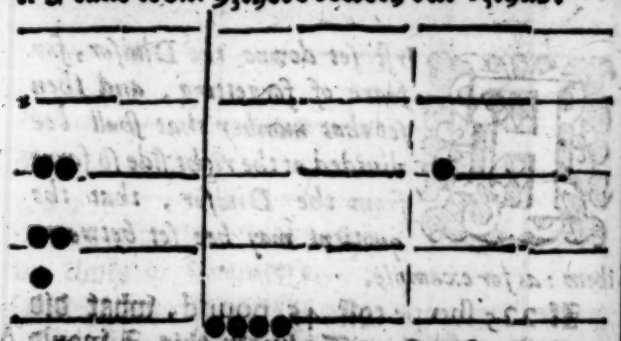
*First set downe the Diuisor, for feare of forgetting, and then set that number that shall bee diuided at the right side so farre from the Diuisor, that the quotient may bee set betweene them: as for example.*

If 225 sheepe cost 45 pound, what did euery sheepe cost? To know this, I would diuide the whole summe, that is 45 pound, by 225, but that cannot be: therefore must I first reduce that 45 pound, into a lesser denomination, as into shillings, then I multiply 45 by 20, and it is 900: that summe shall I diuide by the number of sheepe, which is 225, these two numbers therefore I set thus: An example of sheepe.



Then begin I at the highest line of the diuidend, and seeke how oft I may haue the

Diuisor therein, and that I may doe foure times: then say I, foure times 2 are 8, which if I take from 9, there resteth but 1, thus:



And because I found the Diuisor 4 times in the diuidend, I haue set, as you see, 4 in the middle roome, which is the place of the quotient: but now must I take the rest of the Diuisor as often out of the remainer: therefore come I to the second line of the diuisor, saying two times 4 make 8, take 8 from 10, and there remaineth 2, thus:

Then come I to the lowest number, which is 5, and multiply it 4 times, so is it 20, that take I from 20, and there remaineth nothing, so that I see my quotient to be 4, which are in value shillings, for so was the diuidend: and thereby I know that if 225 sheepe cost 45 pound, euery sheepe cost 4 shillings.

Scholar.



Scholar. This can I doe as you shall perteine by the example. If 160 Souldiers doe spend euery moneth 68 pound, what spendeth each man? Examples of souldiers wages.

First, because I cannot diuide the 68 by 160, therefore I will turne the pounds into pence by multiplication, so shall there bee 16320 pence: now must I diuide the summe by the number of Souldiers, therefore I set them in order thus:

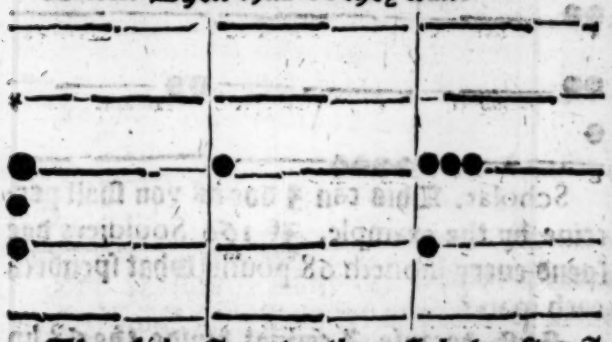


Then begin I at the highest place of the diuidend, seeking my Diuisor there, which I finde once, therefore I set 1 in the nether line.

Master. Not in the neather line of the whole summe, but in the neather line of that worke, which is the third line.

Scholar. So standeth it with reason.

Master. Then thus do they stand.



Then seeke I againe the rest, how often I may finde my diuisor: and I see that in 300 I might finde 100 three times: but then the 60 will not be so often found in 20, therefore I take 2 for my Quotient; then take I 100 twice from 300, and there resteth 100, out of which with the 20 that maketh 120, I may take 60 also twice, and then stand the numbers thus:



Where I haue set the quotient 2 in the lowest line: so is euery Souldiers portion 102 pence, that is 8 shillings 6 pence.

Master. But yet because you may fully perceiue the reason of Diuision, it shall bee good that you set your diuisor still against those numbers from which you do take it, as by this example I will declare.

If the purchase of 200 acres of ground did cost 260 pound, what did one acre cost?

First will I turne the pounds into pence, so will there be 69600 pence. Then in setting downe these numbers, I shall do thus: An example of purchase.

First set the dividend on the right hand as it ought, and then the diuisor on the left hand against those numbers from wich I intend to take him first, as here you see where I haue set the diuisor two lines higher then his own place.

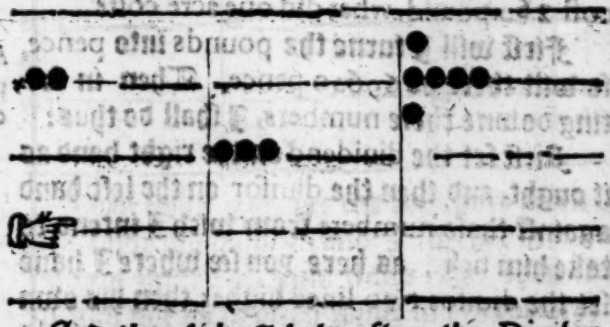


Scholar. This is like the order of diuision by the pen.

Master. Truth you say, and now must I

for the quotient of this worke in the third line, for that is the line of vnites in respect of the Diuisor in this worke.

Then I seeke how often the Diuisor may bee found in the diuidend, and that I find 3 times, then set I 3 in the third line for the quotient: and take away that 60000 from the diuidend and further I set the Diuisor one line lower: as you see here.



And then seeke I how often the Diuisor will bee taken from the number against it, which will be foure times, and 1 remaining.

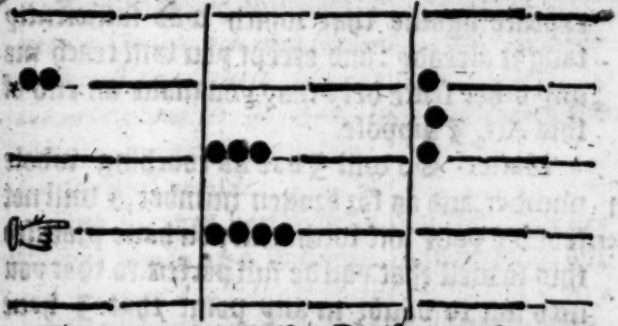
Scholar. But what if it chance that when the Diuisor is so removed, it cannot be once taken out of the diuidend against it?

Master. Then must the Diuisor be set in another line lower.

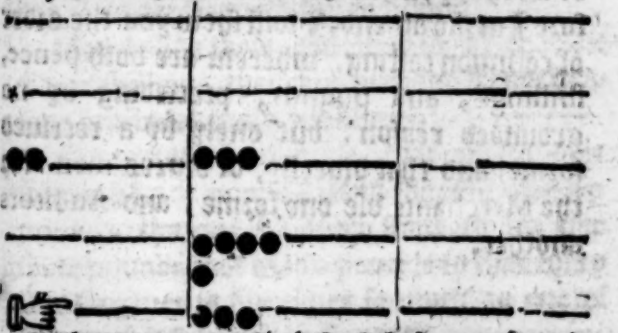
Scholar. So was it in Diuision by the pen, and therefore was there a Cipher set in the Quotient: but how shall that be noted here?

Master. Here needeth no token, for the lines do represent the places, onely loke that you set your Quotient in that place which standeth

standeth for vnites in respect of the Diuisor. But now to returne to the example: I finde the Diuisor foure times in the diuidend, and 1 remaining: for 4 times 2 make 8, which I take from 9, and there resteth 1, as this figure following sheweth: and in the middle space for the Quotient, I set 4 in the second line, which is in this worke the place of vnites.



Then remoue I the Diuisor to the next lower line, and seeke how often I may haue it in the Diuidend, which I may do here 8 times iust, and nothing remaine, as in this forme.



Where you may see ỹ the whole quotient is 348 pence, that is, 29 shillings, whereby I know that

that so much cost the purchase of one Acre.

Scholar. Now resteth the proues of Multiplication, and also diuision.

Master. Their best proues are each one by the other, for Multiplication is proued by diuision, and Diuision by Multiplication, as in the worke by the pen you learned.

Scholar. If that be all you shall not need to repeate againe that which was sufficiently taught already: and except you will teach me any other feate here may you make an end of this Art, I suppose.

The reason of all the former rules.

Master. So will I doe as touching whole number, and as for broken number, I will not trouble your wit with it, til you haue practised this so well that you be full perfect, so that you need not to doubt in any point that I haue taught you, and then may I boldly instruct you in the Art of fractions or broken numbers. wherin I will also shew you the reasons of all that you haue now learned. But yet before I make an end, I will shew you the order of common casting, wherein are both pence, shillings, and pounds, proceeding by no grounded reason, but onely by a receiued forme, and that diuerſly, of diuers men: for the Merchants vse one forme, and Auditors another.

Merchants

# Merchants vſe.

BVt firſt for *Merchants forme*, marke this example here, in which I haue expreſſed this ſumme 198 pounds, 19 ſhillings, 11 pence. *So that you may ſee that the loweſt line ſerueth for pence, the next aboue for ſhillings, the third for pounds, and the fourth for ſcores of pounds.*



Merchants Accompt.

And further you may ſée that the ſpace betweene pence and ſhillings may receiue but one counter (as all other ſpaces likewiſe do) and that one ſtandeth in that place for 6 pence.

Likewiſe betweene the ſhillings and the pounds one counter ſtands for 10 ſhillings.

And betweene the pounds and 20 pounds, one Counter ſtandeth for 10 pound.

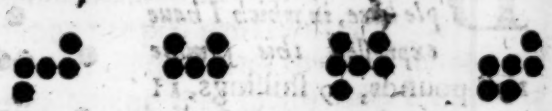
But beſide thoſe, you may ſée at the left ſide of ſhillings, that one number ſtandeth alone and betokeneth 5 ſhillings.

So againſt the pounds, that one Counter ſtandeth for 5 pound. And againſt the 20 pounds, the one Counter ſtandeth for fiue ſcore pounds, that is, 100 pounds ſo that euery ſide Counter is fiue times ſo much as one of them againſt which he ſtandeth.

# Auditors Accompt.

Auditors Accompt.

*NOw for the Accompt of Auditors, take this example.*



Where I haue expreſſed the ſame ſumme 198 pound—19 ſhillings—11 pence.

But here you ſee the pence ſtand towards the right hand, and the other increaſing orderly toward the left hand.

Againe you may ſee, that Auditors will make two lines (yea and more) for pence, ſhillings, and all other values, if their ſummes extend thereto. Alſo you ſee that they ſet one Counter at the right end of each row, which ſo ſet there, ſtandeth for fiue of that roome, and on the left corner of the row it ſtandeth for 10 of the ſame row.

But now if you would adde, or ſubtract after any of both thoſe ſorts, if you marke the order of the other ſeate which I taught you, you may eaſily doe the ſame here without much teaching: for in Addition, you muſt firſt ſet downe one ſumme, and to the ſame ſet the other orderly, and in like manner, if you haue many: but in Subtraction, you muſt ſet downe firſt the greateſt ſumme, and from it muſt you abate

abate the other, euery Denomination from his due place.

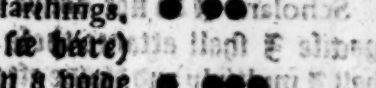
Scholar. I do not doubt but with a little practise I shall attaine these both: but how shall I multiply and diuide after these formes?

Master. You cannot duely do any of both by these sorts, therefore in such case you must resort to your other Arts.

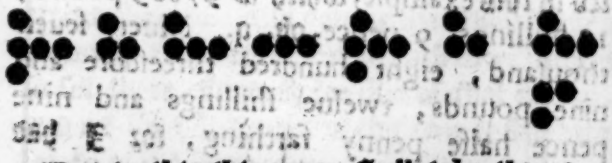
Scholar. They that vse such accounts that it exceed 200 in the summe they set not 5 at the left hand of the scores of pounds, but they set all the hundreds in another farther row, and 500 at the left hand thereof, and the thousands they set in a farther row yet, and at the left side thereof they set the 5000, and in the space ouer, they set the 10000, and in a higher row 20000, which all I haue expressed in this example, which is 97869 pounds, 12 shillings, 9 pence, ob. q. Ninety seuen thousand, eight hundred threescore and nine pounds, twelue shillings and nine pence halfe penny farthing, for I had

not

not told you before, where neither how you should set downe farthings, which (as you see here) must bee set in a voide place standing beneath the pence, for a farthing, one counter, ob. 2 counters, for ob, farthing 3 counters, and more there cannot be: for 4 farthings make 1 d, which must be set in his due place.



And if you desire the same summe after Auditors manner, for here it is:



But in this thing you shall take this for sufficient, and the rest you shall obserue as you may see by the working of each sort, for the diuers wits of men haue inuented diuers and sundrie wayes, almost innumerable.

THE

# THE SECOND PART OF ARITHMETICKE, touching Fractions, briefely set forth.

Scholar.

*Albeit I perceiue your manifold businesses doth so occupy or rather oppresse you, that you cannot as yet compleatly end the Treatise of Fractions Arithmeticall, which you haue prepared, wherein not onely sundrie workes of Geometry, Musicke, and Astronomy bee largely set forth, but also diuers conclusions and naturall workes, touching mixtures*

Arithmeticall fractions.

*mixtures of Metals and compositions of medicines, with other strange examples. Yet in the meane season, I cannot stay my most earnest desire, but importunely crave of you some briefe preparation toward the vse of Fractions, whereby at the least I may be able perfectly to vnderstand the common workes of them, and the vulgar vse of these rules, which without them cannot well bee wrought.*

Master. If my leasure were as great as my will is good, you should not need to vse any importunate craving, for the attaining of that thing, whereby I may bee perswaded that I shall any wayes profit the Commonwealth, or helpe the honest studies of any good members in the same: wherefore while mine attendance will permit me to walke and talke, I am well willing to helpe you as I may.

What a Fraction is

Wherefore first to beginne with the explication of this name Fraction, what take you it to bee?

Scholar. Mary Sir, I think a Fraction (as I haue heard it often named) to be a broken number, that is to say, to be no whole number but part of a number.

Master. A Fraction indeed is a broken number, and so consequently the part of another number: but that must be vnderstood of such another number as cannot bee diuided into any other parts then Fractions: for although I may take the third part of 60, or

the

the fourth part of it, and ſo of other parts diuerſity, yet theſe parts be not properly, nor ought not to be called Fractions, becauſe they may be expreſſed by whole numbers, for the third part of it is 20, the fourth part is 15, the twelfth part is 5, and ſo forth of other parts, all which be whole numbers.

Wherefore properly a Fraction expreſſeth the parts or part onely of a vnite, that is to ſay, that the number which is the whole or entire ſumme of any Fraction, may not bee greater then one: and therefore it followeth, that no one Fraction alone can bee ſo great, that it ſhall make 1, as by example I will declare, as ſoone as I haue taught you to knowe the forme how a Fraction is expreſſed or repreſented in writing. What a fraction is properly.

Nume-

# Numeration.

The expressing of fractions.

*But first to begin with expressing of a* Fraction, *which is the numeration of it: you must understand that a* Fraction *is represented by two numbers set one ouer the other, and a line drawne betweene them as thus,* $\frac{1}{3}\ \frac{3}{4}\ \frac{2}{5}\ \frac{10}{17}$, *which foure fractions you must pronounce thus:* $\frac{1}{3}$ *one third part,* $\frac{3}{4}$ *three quarters,* $\frac{2}{5}$ *two fift parts,* $\frac{10}{17}$ *ten seuenteene parts.*

Scholar. I vnderstand the forme of their expression and pronunciation: but their meaning or valuation seemeth more obscure. Yet I thinke that by the two first fractions I vnderstand the valuation of the two latter fractions, and consequently of other.

Master. Value them then, that I may perceiue your taking of them.

Scholar. $\frac{2}{5}$ betokeneth two fift parts, that is to say, if one be diuided into 5 parts, that fraction doth expresse two of those 5 parts: $\frac{10}{17}$ doth signifie, that if one be diuided into 17 parts, I must take ten of them. And this I gather of the two first examples: for $\frac{1}{3}$, that is, one third part, doth easily declare, that if one thing bee diuided into three parts, I must take out one of them; so $\frac{3}{4}$, that is three quarters, doth declare that one being diuided into foure quarters, I must take (for this Fraction) three of

of those quarters.

If there be no more difficulty in their Numeration, then I pray you go forward to their Addition and Subtraction, and so to the other kindes of workes. For I vnderstand that the same kindes of workes be in fractions, that be in whole numbers.

Master. There are the same kindes of workes in both, albeit the order of them is diuers, as I will anone declare: but yet more in Numeration before we leaue it. You must vnderstand that those two numbers which expresse a Fraction, haue seuerall names, the ouermost, which is aboue the line, is called the Numerator, and the other beneath the line, is called the Denominator.

Numerator.

Denominator.

Scholar. And what is the reason of their diuers names? For (in mine opinion) both be Numerators, seeing both they do expresse the numeration of the Fraction.

Master. You are deceiued: for one onely (which is the ouermost) doth expresse the Numeration, and the Denominator doth declare the number of parts, into which the vnite is diuided, as in this example, when I say: diuide a pound weight of Gold between foure men, so that the first man shall haue $\frac{3}{15}$, the second $\frac{3}{15}$, the third $\frac{4}{15}$, and the fourth $\frac{6}{15}$.

Now do you perceiue that by the Denominator (which is one in all foure fractions) it is intended that the pound weights should be diuided into so many parts, I meane 15,

and by the foure ſeuerall Numerators is limitted the diuers portion that each man ſhould haue, that is, that when the whole is parted into 15, the firſt man ſhall haue two of thoſe 15 parts: the ſecond man three of them: the third man foure: and the fourth man ſixe. And ſo may you ſée the ſeuerall offices (as it were) of thoſe two numbers, I meane of the Numerator and the Denominator.

And hereby you perceiue that a man can haue no more parts of any thing then it was diuided into, neither yet aptly ſo many: ſo that it were vnaptly ſaid: You ſhall haue $\frac{15}{15}$ that is 15 fifteene parts of any thing, ſeeing it were better ſaid, you ſhall haue the whole thing.

Scholar. So doth it appeare reaſonably, for the labour is vaine to diuide any thing, and then to apply the Diuiſion to no vſe. And much leſſe reaſonable were it to ſay $\frac{16}{15}$: for if the whole be diuided into 15 parts onely, it is not poſſible to take 16 of them, that is to ſay, more then all together.

Maſter. This is true touching the proper and apt vſe of the name of a Fraction: yet improperly (and after a vulgar acceptation for eaſineſſe in worke) both thoſe formes bée called Fractions, becauſe they be written like fractions, although they be none indéed: for $\frac{15}{15}$, and generally all ſuch other, where the Numerator and Denominator be equall, are not fractions, but the whole thing withall his parts. And ſo $\frac{14}{15}$ is not to be called a fracti-

on,

on, but a mixt number, of a whole number and a fraction, for it is as $1\frac{3}{13}$, that is, one whole and $\frac{3}{13}$ parts, as shall be declared in Reduction. Therefore they do abuse the names that call them Fractions, where the Numerator is either equall, or greater then the Denominator.

An improper fraction of a mixt number.

Scholar. But is there any needfull cause, why they should so abuse the name?

Master. There is cause why they shall sometimes for easinesse in worke with some numbers after that sort like fractions: but they need not to call them fractions, but (as they bee) whole numbers or mixt numbers, (that is, whole numbers with Fractions) expressed like fractions, or as improper fractions.

Now must you understand, that as no fraction properly can be greater then one, so in smallnesse under one the nature of fractions doth extend infinitely, as the nature of whole numbers is to increase above one infinitely, so that not onely one may be divided into infinite fractions or parts, but also every fraction may be divided into infinite Fractions or parts, which commonly be called Fractions of fractions, and they be expressed diversly: as for example, $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{1}{2}$, that is three quarters, of two third parts, of one halfe part. Whereby is signified, that if one be divided into two halfes, and the one halfe into three parts, and two of those

Fractions of Fractions.

three parts be diuided equally into foure quarters, this fraction of fractions doth represent three of those quarters.

Scholler. I pray you let me proue by an example in common money, whether I doe rightly vnderstand you or no. One Crowne which I take for an vnite, doth containe 60 pence; therefore the halfe of it is 30 pence, $\frac{2}{3}$ of that halfe is 20 pence, whereof $\frac{3}{4}$ is fifteen pence, so then 15 pence is $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{1}{2}$ of a Crowne: and so is 3 pence $\frac{1}{5}$ of $\frac{2}{3}$ of $\frac{1}{2}$ of a shilling.

Maister. You perceiue this well enough: yet this note I giue you by the way, that the forme of expressing these fractions is voluntary, and hath no other reason than the will of the Diuisor, which forme many follow: for some expresse them thus $\frac{3}{4}\ \frac{2}{3}\ \frac{1}{2}$, without any figure of distinction betweene them, which forme all commonly follow. Some other do make lines betweene euery fraction, and adde words of distinction, after this sort, $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{1}{2}$, which forme is best.

☞ Some other expresse them thus in stead of the former, to distinct their seuerall fractions of one whole number, for if they were set in one right line thus, $\frac{3}{4}, \frac{2}{3}, \frac{1}{2}$, then ought it to be pronounced, three quarters and two third parts, and a halfe, which maketh almost two whole vnites, lacking but one twelfth part. And so is it nothing agreeable

with

with the other fraction of fractions: wherefore it is a great ouerſight in certaine learned men, which do expreſſe them ſo confuſedly with ſuch ſeuerall fractions, that a man cannot know the one from the other.

*Therefore ſome men (as* Stifelius*) do expreſſe without a line, numbers of proportion, being applied to* Addition *or* Subtraction, *becauſe they muſt be taken as two, where the line in* fractions *maketh them to be taken for one: For of the* Numerator *and* Denominator *is made one number.*

Scholar. Then I perceiue there be three ſeuerall varieties in fractions: firſt, when one onely fraction is ſet for one number, as $\frac{4}{5}$, that is, foure fift parts. The ſecond is, when there be ſet two or more ſeuerall fractions of one number, as $\frac{4}{9}, \frac{2}{5}$, that is, foure ninth parts, and two fifth parts. The third ſort is fractions, of fractions, as $\frac{4}{9}$ of $\frac{2}{5}$, that is, foure ninth parts of two fifth parts. Three ſeuerall varieties.

Maſter. You haue ſaid well, if you vnderſtand well your owne words.

Scholar. If it ſhall pleaſe you I will by an example in the parts of an old Engliſh Angel, expreſſe my meaning.

Maſter. Let me heare you.

Scholar. The old Engliſh Angel did containe 7 ſhillings 6 pence, that is, 90 pence: Now $\frac{4}{5}$ of it is 72 pence. And of the ſame 90 pence, if I take $\frac{4}{9}$ and $\frac{2}{5}$, that is, foure nine parts, and two fift parts, $\frac{4}{9}$ is 40, and $\frac{2}{5}$ is 36, which both make 76: but if I take $\frac{4}{9}$ of $\frac{2}{5}$, that

is, foure nine parts of two fifth parts, letting $\frac{1}{5}$ is but 36, then $\frac{1}{5}$ of 36 will yéeld but 16, for $\frac{1}{5}$ of 36, is but 4, and that taken foure times maketh 16.

Master. This is plainly expressed, and truly, and hereby (I doubt not) but you do perceiue, that as great a difference, as is betweéne 16 and 76, so much difference is betweéne those two fractions $\frac{4}{9}$ and $\frac{2}{7}$: and $\frac{4}{9}$ of $\frac{2}{7}$.

And now that you vnderstand these varieties, I will proceéd to the rest of the workes: first, admonishing you, that there is another order to bée followed in Fractions, then there was in whole numbers: for in whole numbers this was the order: Numeration, Addition, Subtraction, Multiplication, Diuision, and Reduction: but in fractions (to follow the same aptnesse in proceéding from the easiest workes to the harder) we must vse this order of workes, Numeration, Reduction, Addition, Subtraction, Multiplication and Diuision.

The order of works in fraction.

Scholar. That Addition and Subtraction should go together, and Diuision to follow Multiplication, naturall order doth perswade: but why Reduction should bée first in order here next to Numeration, and Addition, and Subtraction in the middle, I desire to vnderstand the reason.

Master. As in the Art of whole numbers, ☞ Order would reasonably begin with the easiest, and so go forward by degrées to the hardest:

hardest: euen reason teacheth in fraction the like order. And consider that Addition or Subtraction of fractions can very seldome bee wrought without Reductiō: and contrariwise, Reduction may bee wrought without this forme of Addition or Subtraction: therefore was it orderly required, that Reductiō should go before Addition and Subtraction, and this reason serueth for the placing of Reduction before the other.

Scholar. Then, if Reduction be the eastest, I pray you declare the forme of it first by Rule, and then by example.

Master. Your request is good.

# Reduction of Fractions.

Of Reduction of Fractions, there are fiue varieties.

THerefore will I now declare the diuerſities of *Reduction of fractions*, which commonly hath fiue varieties, or formes.

1 *Firſt*, when there be ſundrie *Fractions of one intire vnite*, they muſt be reduced to one denomination, and alſo into one *Fraction*.

2 *Secondly*, when there be proponed fractions of fractions, they muſt bee reduced likewiſe into one fraction: for otherwiſe they cannot be brought into one denomination.

3 *Thirdly*, when an improper fraction is proponed, that is to ſay, a fraction in forme, which indeed, is greater then an vnite: it muſt bee reduced into apt forme, expreſſing the vnite or vnites of it, and the proper fraction diſtinctly. And ſometimes alſo it ſhall be needful to conuert ſuch a mixt number of vnites with fractions, into the forme of a fraction, that is, into an improper fraction: which two formes I eſteeme but as one, becauſe they worke one kinde of number.

4 *Fourthly*, there happeneth ſometimes fractions to be written in great numbers, which might bee written in leſſer numbers: therefore is there a meane to reduce ſuch great numbers into their ſmalleſt termes.

5 *Fifthly*, when any fraction betokeneth the parts of a whole thing, which hath by common partition certaine

*certaine parts, but none of like denomination with that Fraction, then may you reduce the said fractions into another, whose denomination shall expresse the common parts of that whole thing.*

Scholar. This distinction in doctrine delighteth me much, but more with hope then present fruit: for as yet I do not vnderstand scarcely the varieties, and much lesse the practise and vse of their workes.

Master. Reduction is an orderly alteration of numbers out of one forme into another, which is neuer done orderly but for some needfull vse, as in euery of the said fiue seuerall formes, I will distinctly declare.

The first forme of Reduction

First therefore, when two, or more seuerall fractions of any vnite be proponed; as for example $\frac{3}{16}$ and $\frac{4}{6}$, because it is hard to tell what proportion of the intire number those two Fractions do expresse, therefore was Reduction diuised, to be a meane whereby these seuerall fractions might be brought into one denomination and fraction.

And in these fractions, this is the Art for bringing them to one denomination.

How to reduce fractions: of diuers denominations into one denomination.

*Multiply first the denominators together, and the totall thereof you shall set twice down vnder two seuerall lines for two new denominators, or rather for one common Denominator. Then multiply the Numerator of the first fraction, by the denominator of the second, and set the totall thereof for the Numerator ouer the first line. Likewise multiply the Numerator of the second fraction by the denomina-*

*tor of the first, and set that to all ouer the second line for the Numerator of that fraction: and so are those two first fractions of seuerall denominations, brought to one denomination.*

Scholar. If I vnderstand you, as I thinke I doe, my example shall declare the same. The fractions which you proponed were these, $\frac{3}{16}$, and $\frac{4}{6}$, whose denominators (being 16 and 6) I multiply together, and there amounteth 96, which I set vnder two lines thus: $\frac{\ }{96}$, $\frac{\ }{96}$.

Then I multiply the Numerator of the first fraction by the Denominator of the second saying, 3 into 6 maketh 18, that I set ouer the first line for a new Numerator, and it will be thus $\frac{18}{96}$.

Likewise I multiply the Numerator of the second fraction by the Denominator of the first saying, 4 times 16 maketh 64, that I set for the second Numerator, and the fraction will appeare thus, $\frac{64}{96}$.

So that both fractions brought to one denomination, must stand thus. $\frac{18}{96}$ and $\frac{64}{96}$.

Master. You haue done well.

Scholar. I beseech you let me examine it after my accustomed forme, by common parts of coyne or other measure.

Master. Go to.

Scholar. I haue a peece of Gold which is accounted worth 8 shillings, and containeth 96 pence, whereof $\frac{1}{12}$, that is, the twelfth part, is 6 pence, and $\frac{3}{16}$ is 18 pence, that is

is $\frac{24}{96}$. Againe $\frac{1}{6}$ of the same peece of gold is 16 pence, so that $\frac{4}{6}$ parts maketh 64 pence, that is $\frac{64}{96}$. And so I finde the summes to agree with the other before.

Master. *So haue you now the Art to bring two such fractions into one denomination. And if there be more then two, then must you multiply all the Denominators together, and set the totall thereof so many times downe as there bee fractions; and then to get for each one a new Numerator, multiply the Numerator of the* first, *by the Denominator of the* second, *and the totall thereof multiply by the Denominator of the* third, *and so forth, if there bee more. Likewise multiply the Numerator of the* second, *by the Denominator of the* first, *and the totall thereof by the Denominator of the* third. *And in the same sort multiply the Numerator of the third into the Denominator of the* first, *and the totall thereof into the Denominator of the* second, *and so forth, if there were moe. So these three fractions* $\frac{2}{1}$ $\frac{3}{4}$ $\frac{2}{3}$ *doe make by Reduction these other three fractions of Denomination* $\frac{24}{60}$, $\frac{45}{60}$, $\frac{40}{60}$. *All which you may bring into one fraction by adding the Numerators together, and putting the totall for the totall Numerator, reserving still that same common Denominator. And these three fractions make one improper fraction, thus:* $\frac{109}{60}$.

Note the Reduction of three Fractions or more, into one.

Scholar. All this I perceiue, and also that this last fraction is more then an vnite, and therefore you did call it an improper fraction.

Master.

Maſter. There be certaine other formes of working in this Reduction, which I will briefly touch alſo, to giue you an occaſion to exerciſe your wit therein.

The firſt variety of Reduction

*The firſt variety is this: When you haue made and written downe your common Denominator (as I haue taught before) then to get a Numerator for the firſt, do thus: Diuide the common denominator by the denominator of the firſt fraction, and the quotient multiplied by the Numerator of the ſame, yeeldeth a new Numerator for the firſt new fraction. So likewiſe doe with the ſecond and the third, and with all the reſidue, if there be more.*

Scholar. That will I proue in your laſt example of theſe three fractions $\frac{2}{5}\,\frac{3}{4}\,\frac{2}{3}$. When the denominators be multiplied, they make 60: for 5 into 4 maketh 20, & 20 by three yeeldeth 60, that I ſet down three times thus: $\frac{\cdot}{60}\,\frac{\cdot}{60}\,\frac{\cdot}{60}$ then to haue a Numerator, for the firſt, I muſt diuide 60 by 5 (the denominator of the firſt) and the quotient is 12, which I muſt multiply by 2 (the Numerator firſt) and that maketh 24, and ſo haue I for the firſt fraction $\frac{24}{60}$.

Likewiſe for the ſecond fraction: I diuide 60 by 4, and there commeth 15, which I multiply by 3, and ſo haue I 45, for the ſecond fraction $\frac{45}{60}$. Then for the third in like ſort will come $\frac{40}{60}$.

The ſecond variety.

Maſter. *Another way is this: If it happen ſo, that the leſſer denominator can by any multiplication make the greater, then note the multiplier, and by it multiply the Numerator ouer that leſſer denomina-*

*tor,*

*ter, & for the leſſer denominator put the greater, as thus in theſe two fractions* $\frac{3}{12}$ *and* $\frac{2}{3}$, *three being the leſſer denominator multiplied by* 4, *will make* 12, *which is the greater denominator: therefore by the ſame* 4 *I do multiply* 2 *which is the Numerator ouer* 3, *and that maketh* 8: *vnder which I do put* 12, *being the greater denominator, which is alſo made by multiplication of* 4 *into* 3, *and ſo haue I theſe two fractions* $\frac{3}{12}$, $\frac{8}{12}$, *thus ſhortly reduced, without altering the one fraction.*

Scholar. This I vnderſtand.

Maſter. *Then marke this third way: If the denominators do not happen ſo, that one by multiplication may make the other, then looke whether they both may be parts of any other one number, as in* $\frac{5}{12}$, *and* $\frac{7}{18}$, *although the leſſer taken but twice, be too much to make* 18, *yet they both may be parts vnto* 36: *therefore looke how many times twelue is in* 36, *and that quotient being multiplied by the Numerator ouer* 12, *the totall ſhall be put in ſtead of the Numerator ouer* 12, *and for* 5 *put* 15, *thus* $\frac{15}{36}$. *So likewiſe looke how often is* 18 *in* 36, *becauſe it is twice, therefore by* 2 *multiply* 7, *which is ouer* 18, *and it will be* 14: *ſet that for the Numerator, and in ſtead of* 18 *put* 36; *and then your Fractions reduced ſtand thus,* $\frac{15}{36}$, $\frac{14}{36}$, *in ſtead of* $\frac{5}{12}$ *and* $\frac{7}{18}$. The third variety.

And if you will proue whether you haue wrought well or no, that may be proued by Reduction of them againe to their former denominations, which Art, ſhall be taught in the fourth kinde of Reduction, where greater termes of Fractions be reduced into ſmaller in Proofe.

number

☞ number, but no smaller in proportion. And if in such Reduction the same termes or numbers come againe that were before, then is the worke good, else not.

Scholar. Sir, I heare your words, but I do not vnderstand many of them: which I pray if it please you, declare.

Master. With a good will, when conuenient place serueth, but that must bee in the last fourth kinde of Reduction, which teacheth how to reduce fractions of fractions into one fraction, and so to one Denomination.

The second forme of Reduction of fractions of Fractions into one Fraction and Denomination.

*When Fractions of Fractions be proponed, you shall multiply the Numerators of each into other, and set the totall for the new Numerator, and then multiply all the denominators likewise, and take their totall for the new Denominator, and so are they speedily reduced.*

Scholar. If that be all, then I vnderstand it already, as by this example I will declare. Theſe be the fractions, $\frac{1}{4}$ of $\frac{2}{3}$, of $\frac{6}{7}$ of $\frac{7}{9}$, which I would reduce to one Denomination, and proper simple fraction.

Therefore begin I with the Numerators, and multiply them together, saying, 3 into 2, maketh 6: and 6 by 6, maketh 36, which multiplied by 7, yeeldeth 252: that I set ouer a line for the Numerator, thus, 252

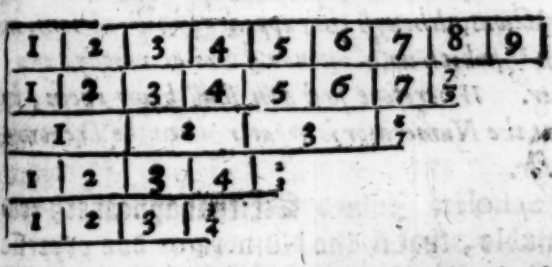
Then I multiply the denominator, 4 by 3, maketh 12, and that by 7 bringeth 84, which multiplyed by 9, yeeldeth 756, the new

new Denominator. And so the whole reduced fraction is this, which is too hard a fraction for me to understand yet. $\frac{252}{756}$

Master. You thinke so, and no marvell, but anon you shal learne to judge it easily: for this Fraction is no more indeed then $\frac{1}{3}$, although it be in greater termes, and therefore more stranger, and more obscure.

and this sufficeth for this Reduction, save that I will shew you by a figure of measure, the true rate and reason of this kinde of fractions, and also the due understanding of their Reduction.

*The entire measure parted into 9.*




Here you se the longest measure, (which standeth for the whole and entire quantity) first parted into 9. divisions, whereof 7 are covered by the second measure: and thereof again are parted out 6, and that 6 being distinct into three parts, two of them are parted by the fourth measure, of which fourth measure being divided into foure parts, the lowest

measure doth containe $\frac{1}{4}$, so that the same $\frac{1}{4}$ must bée named, not $\frac{1}{4}$ of the whole measure, but indéed is $\frac{1}{4}$ of $\frac{1}{3}$ of $\frac{6}{7}$ of $\frac{7}{9}$.

Scholar. This Example is so sensible, that I cannot chuse but sée it. And furthermoze sée also, that the same fraction is equall to $\frac{3}{9}$ of the entire measure, as the lines which runne vp and downe doe expresly set forth. Also I sée héere that $\frac{2}{3}$ of $\frac{6}{7}$ is equall to $\frac{4}{9}$. And further yet, that $\frac{2}{7}$ of $\frac{7}{9}$ is equall to $\frac{6}{9}$ or $\frac{2}{3}$.

Master. I am glad that you sée it so well, not doubting but you will gather greater light of knowledge hereby.

The third forme of Reduction of improper Fractions.

*But now it is time that wee come to the third forme of Reduction, which teacheth of improper Fractions, that is to say, mixt numbers of vnites & Fractions, although they appeare like Fractions, as this* $2\frac{6}{5}$, *which doth include 5 vnites wholly, and* $\frac{1}{5}$ *ouer. Wherefore first you shall know them, by that the Numerator is greater then the Denominator.*

Scholar. Indéed Sir, that appeareth reasonable, that if the Numerator doe expresse moze parts to be taken of any vnite, then the Denominator doth signifie that vnite to bé diuided into, it must néeds follow that such a fraction importeth moze then the whole, that is to say, the whole with certaine parts ouer: but what Reduction is there in it?

Two seuerall wayes in this Reduction.

Master. There be two seuerall kindes of Reduction, concerning such Fractions.

Some-

Sometimes it ſhall bee needfull to conuert theſe fractions into vnites, and the propet fractions that will remaine. And ſometimes contrariwiſe, it ſhall bee meet to reduce mixt numbers, that is, vnites written with fractions, into the forme of one ſimple fraction, and ſo be there two wayes.

Scholar. What is the meane of the firſt way to turne improper fractions into vnites with their proper fractions?

Maſter. *That is thus. Your Numerator being greater then the Denominator, muſt be diuided by the ſame Denominator, and the quotient thereof expreſſeth the vnites: the Remainer ſhall be put for the Numerator of the fraction that reſteth, and the Denominator muſt be the ſame that was before.* The firſt way: Reduction of improper fractions into vnites, with their proper fractions.

Scholar. For example, I take $\frac{17}{5}$. And diuiding 17 by 5, the quotient will be 3, and there will remaine 2.

Maſter. That muſt you write thus, $3\frac{2}{5}$ where (you ſee) I haue written 3 without any line, as entire numbers ought to be written, and the 2 that remained I haue ſet ouer the former Denominator with a line as a proper fraction. And this number doth ſignifie now three vnites, and $\frac{2}{5}$ of one.

Scholar. Then if I would by vnites here vnderſtand crownes, ſo it were 3 Crownes, and $\frac{2}{5}$ that is 2 ß.

Maſter. Euen ſo, and therefore $\frac{17}{5}$ did ſignifie the ſame. But this happeneth ſometimes

that when the reduction is so wrought, there remaineth nothing. And then it is not a mixt number, but a simple entire number, represented like a fraction.

The second way.

Scholar. As $\frac{12}{2}$ will make 3 full, and $\frac{18}{3}$ will make euen 6. This I will remember. But now, what is the second forme of Reduction that you speake of, for these sorts of fractions?

Reduction of whole numbers either alone, or ioyned with fractions into improper fractions.

Master. *Whensoeuer you haue any of these two sorts of numbers, that is to say, whole numbers without fractions, or whole numbers with fractions, and you would turne them into the forme of a fraction, you must multiply the whole number by that denominator which you will haue to remaine still, and to the totall thereof adde the Numerator, which you haue already, and all that shall you set for the new Numerator, keeping still the former Denominator: as if you haue* $6\frac{3}{4}$ *which you would conuert into an improper fraction, you must multiply 6 by 4, whereof commeth 24, and thereto adde the numerator which is 3, and so haue you 27 for the numerator, and 4 still for the denominator.*

Scholar. Then is $\frac{27}{4}$ equall to $6\frac{3}{4}$.

Note.

Master. Euen full, and so backward (as appeareth by the former Reduction) $6\frac{3}{4}$ maketh $\frac{27}{4}$. And thus one of these Reductions may be the proofe of the other worke.

Scholar. This I perceiue: But now if you would turne whole numbers without fractions into any fractions, I see not how that may be done, because there is no Denominator to make the multiplication by.

Master.

Master. That is well marked: but this you know, that no man intendeth to turne any whole number into a fraction, but he hath in his minde that Denominator by which the multiplication must be made: for the proofe whereof I set downe 7, which is a whole number. And if you will haue this number conuerted into any certaine fraction, will me to do it.

Scholar. I pray you reduce 7 into a Fraction.

Master. Then you care not what the Fraction be, so it be some Fraction.

Scholar. No, I passe not for the sort of the Fraction.

Master. Then how can you think that you require me to do any thing certaine, when you leaue me to do as I list? And seeing you stand at that stay, whether thinke you that I must first intend in minde what fraction I will make of it, before I can do it indeed?

Scholar. Else you should do ignorantly.

Master. Then will I limit my selfe (seeing you will not) to turne it into quarters. And therefore I multiply 7 by 4 (which is the Denomination of quarters) and there amounteth 28 to be set for the Numerator, and the 4 must be set for the Denominator, and the fraction will be thus $\frac{28}{4}$.

Scholar. Indeed I perceiue this to be reasonable, for without much triall I vnderstand that $\frac{28}{4}$ of any thing doth make 7. And so then

if I would turne 8 into 5 parts, it will make $\frac{40}{5}$, which is all one with 8: for 8 crownes turned into 5 parts, (that is, into shillings) will make 40 shillings, that is $\frac{40}{5}$ of a Crowne.

The fourth forme of Reduction

Master. *Seeing you understand now these three kindes of Reduction, I will declare vnto you the fourth kinde, that is, when fractions be written in greater termes then they need, how they may bee brought to lesser termes.*

Scholar. To write any thing in greater termes then needeth, seemeth to be a fault, and so this Rule seemeth to amend that fault.

Master. It were a fault to doe any thing without need, which after must be redressed: but in this case it is not so, neither did I say absolutely (as you do) that it needeth not to expresse those fractions in so great termes, but that the fractions do not need, I meane for their value to be vnderstood: but yet it may be needfull for the ease of these workes whereto they be applyed, as for example: In the first kinde of Reduction this was your owne example: $\frac{3}{16}$ and $\frac{4}{6}$, which when you would reduce, you were faine to turne them first into one denomination, and so appeared they thus: $\frac{18}{96}$, and $\frac{64}{96}$, where the fractions (for their owne vnderstanding) needed not to be turned out of smaller termes into greater, but yet the easinesse of working needed it.

Scholar. Sir, I vnderstand now, not onely the difference of this need (for the fractions might better be vnderstood as fractions

seue-

seuerall, each in his value, when they were in lesser termes, although they could not so well be reduced) but also I vnderstand what you meane by greater termes and lesser termes, whereof before I was in doubt: for I see you call the Numerator and Denominator, the termes of the fraction. Termes of Fractions.

Master. *I am glad you vnderstand it so well: Now then when you would value any fractions (because they may best bee done when the termes are smallest) you shall reduce them to the smallest that you can, which thing you may doe thus: Diuide the greatest of any such two termes by the lesser, and if any thing remaine by that remainer, diuide the last diuisor: and if any thing remaine now, by that diuide the first diuisor (which was before the remainer of the last diuision) and so continue still, till nothing doe remaine in the diuision: and then marke your last diuisor, for it is the number that will easily reduce your fractions, if you diuide both the numerator and the denominator by the same number, and put for the numerater the quotient of his diuision, and for the denominator also his quotient, that riseth by his diuision.* Reduction of Fractions, into their smallest termes or least value,

Scholar. I take for example $\frac{18}{96}$, and because 96 is the greatest number, I diuide it by 18, and the quotient is 5, and there resteth 6: what shall I doe with this Quotient?

Master. Nothing in this worke, but now seeing there remaineth somewhat, by that remainer must you diuide the last Diuisor.

Scholar. If I shall diuide 18, (which was

the last Diuisor) by 6, that was the remainer, so is the quotient 3, and nothing resteth.

Master. As for the Quotient I omit him yet: but because there doth remaine nothing therefore is 6 (which was your last Diuisor) that number by which you may reduce the Fraction proponed.

Scholar. Then as you taught me, I must diuide the Numerator 18 by 6, and the quotient is 3, which I must put for the Numerator ouer a line, thus; $\frac{3}{}$ And then by the said 6 must I diuide also the Denominator 96, and the Quotient will be 16, which I must take for the Denominator, and so is the Fraction $\frac{3}{16}$. And se me thinketh this Rule doth proue the worke of the first Reduction.

Master. That is true, if the first Reduction were made of fractions into their least termes, and else not, without some helpe, as the second number in that place will declare.

Scholar. The second number was $\frac{2}{3}$ which was turned into $\frac{64}{96}$ by that Rule. Now if I shall by this Rule reduce it againe into the least termes, I must diuide 96 by 64, and there remaineth 32, wherefore I must take that 32 for the Diuisor, to reduce the said fractions. Then doe you diuide 64 by 32, and the quotient is 2, which I set for my numerator. Againe, I diuide 96 by 32, and the quotient will be 3, and so I haue but $\frac{2}{3}$.

Master. Muse not at the matter, for you haue

haue done well enough: but you thinke you haue not the fraction that you looked for, that is, $\frac{4}{5}$, yet haue you one equall to it, as by the parts of a shilling you may proue.

Scholar. Truth it is for each of them will bring forth 8 pence, so that $\frac{8}{12}$ and $\frac{8}{10}$, and $\frac{8}{20}$, be all three equall. And now I perceiue that because $\frac{8}{20}$ was not written in the least terms that it might be therefore this Reduction brought forth not it, but that other which is written in the least termes. Now vnderstand I this rule well. But is there any other way to worke this Reduction?

Another way to worke this Reduction

Master. *Yes, but first note this, that if you find no such Diuisor to reduce the Fraction till you come to* 1, *because one doth make no Diuision: therefore that Fraction is already in his least termes, as by* $\frac{71}{100}$ *you may proue, and so of* $\frac{85}{98}$, *and many other like.*

Note that to mediate any number is to diuide by two.

*But now for your better aid to finde the due proportion in least termes, with more ease for a yong learner, you shall mediate or take the halfe of the Numerator, and also of the Denominator as long as you may vpon a line, alwayes parting them with a right downe dash of your pen as you worke, which may easily bee done, if the number bee euen: as* 2, 468, *or* 10, *but if they be odde (though it be but one of them) then must you abreuiate them by* 3, 5, 7, *or* 9, *&c.*

And because examples doe most instruct, I haue here set downe the manner of two or three, whose last number at the end of the line shew-

sheweth the least terme or valuation of that fraction.

As for example, I would reduce $\frac{288}{576}$ into his least terme or value, whereupon I set forth $\frac{288}{576}$ with a long line drawne from it thus:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 288 | 144 | 72 | 36 | 18 | 9 | 3 | 1 |
| 576 | 288 | 144 | 72 | 36 | 18 | 6 | 2 |

And because both the Numerator, and the Denominator end in euen numbers, I see this may be abreuiated by 2, or 4, or 6, &c. Therefore on the other side of the right downe dash toward the right hand, I first take the halfe of the Numerator: saying, the halfe of 2 is 1, the halfe of 8 is 4: and againe, the halfe of 8 is 4: which 144 is now a new Numerator, and therefore I part it with a right downe dash, as before.

Then doe I also take the halfe of 576, in saying, the halfe of 5 is 2, and the halfe of 17 is 8, and the halfe of 16 is 8, and so haue I 288 for a new Denominator.

Then beginning againe: saying the halfe of 144 is 72, and the halfe of 288 is 144: thus continuing the mediation or diuision by 2 vntill you come to the last worke, as appeareth here in the example, where the same is reduced to $\frac{1}{2}$ which is equall to $\frac{288}{576}$.

So this second example $\frac{28}{112}$ first abreuiated by 2, and againe by 2, and last by 7, is reduced to $\frac{1}{4}$ which is equall to $\frac{28}{112}$.

| | | | |
|---|---|---|---|
| 28 | 14 | 7 | 1 |
| 112 | 56 | 28 | 4 |

Againe,

Aguine, $\frac{1465}{4395}$ abbreuiated first by 5, then by 293.

| 1465 | 293 | 1 |
|---|---|---|
| 4395 | 879 | 3 |

Scholar. Sir I thanke you much, this is very easie and good for a yong learner.

Master. So it is, but yet notwithstanding, if you can without that diuision by memory espie the greatest number that may diuide exactly both termes of your fraction proponed, then need you not to vse that diuision, as in this fraction $\frac{60}{96}$, I see that 12 is the greatest number that can diuide them both: and therefore without any worke, by memory onely, I turne that into $\frac{5}{8}$, but this ability in knowledge is got by exercise.

Yet one other way of easie reduction in this kinde there is, when your fraction hath any cyphers in the first places of both termes, then may you by casting away the cyphers, make a briefe reduction as thus: $\frac{100}{400}$ here take away the cyphers, and it will be $\frac{1}{4}$, which is the same in value with $\frac{100}{400}$.

Scholar. And so if I haue $\frac{400}{810}$, it will be $\frac{4}{81}$.

Master. You are deceiued, for you take away more cyphers from the Numerator then you do from the Denominator, which you may not do.

Scholar. I confesse my fault, which came of too much hatte, I was more gladder of the Rule,

Rule then wise in using it: but now I understand it I trust.

Master. Then may I go in hand with the fifth or last kinde of Reduction, which teacheth how to turne any fraction proponed into any other Denomination that you list, or into any parts of common coynes, weights or measures, or such like.

The fifth kinde of Reduction

*For declaration whereof, first you shall marke whether your fraction be a simple Fraction, either else a Fraction of sundry parts, I meane of more termes then two. And if your Fraction be a Fraction of Fractions, or otherwise compound you must reduce it to one simple fraction. And then marke well the Denomination of that other Fraction, into which you would turne this: For by that Denominator you must multiply the Numerator of your first Fraction, and the totall product thereof shall you divide by the Denominator of your first fraction, and that quotient shall be the Numerator of the Denominator proponed: as for example, I have this Fraction* $\frac{3}{5}$, *which I would turne into ten parts: therefore I multiply this* 10 *by* 3, *that is the Numerator of my Fraction, and there ariseth* 30, *which I divide by* 5, *and the quotient is* 6, *which must be the Numerator to* 10, *and so* $\frac{3}{5}$ *will be* $\frac{6}{10}$.

To reduce fractions to a denomination appointed

Scholar. This is easie enough to do.

Master. Then shall you see another example of the same fraction that is not so easie: as if I would turne $\frac{3}{5}$ into 8 parts, prove you that worke.

Scholar. I must multiply 8 by 3, and there amount

amounteth 24, which I diuide by 5, and the quotient is 4, then is the new fraction $\frac{4}{5}$.

Master. And see you nothing doubtfull in this worke?

Scholar. I see that when 24 was diuided by 5, there remained 4, which I did not passe of, because ye spake nothing of any remainer, but onely of the quotient.

Master. By likelihood you remember what I said to you in Diuision of whole numbers, that you should not passe of the remainer there, but onely note it as a summe that could not be diuided without knowledge of Fractions. Wherefore now marke this, that in all diuisions of whole numbers, when there is any remainer, you shall set it ouer a line as a Numerator, and set the Diuisor for the Denominator, and that fraction doth make the Diuision compleat, and is part of the quotient: as if I would diuide 48 by 5, the quotient will be $9\frac{3}{5}$: so in your former worke when 24 was diuided by 5, the quotient should be $4\frac{4}{5}$, and so the new fraction should be thus, $\frac{4}{5}$ and $\frac{4}{5}$ of $\frac{1}{2}$, that is, $\frac{4}{5}$ of the entire number, and $\frac{4}{5}$ of $\frac{1}{2}$ part of any thing, which you may proue by example of some coyne.

Scholar. When I take a crowne, whole $\frac{1}{2}$ is 3 s. Now if I would proue whether the 3 s be $\frac{4}{5}$ and $\frac{4}{5}$ of $\frac{1}{2}$, I shall haue a cumbrous worke to do.

Master. Indeed for whole pence, your example is a little troublesome: yet turning the crowne

crowne into halfe pence, it is eaſie enough.

Scholar. What will I try.

¶ Firſt I ſee that $\frac{1}{3}$ of a Crowne is 3 ſhillings, which is 36 pence, or 72 halfe pence. Now if I can finde that this fraction $\frac{4}{5}$ and $\frac{4}{7}$ of $\frac{1}{3}$ be equall vnto 3 ſhillings, then am I fully anſwered.

Becauſe I cannot take $\frac{4}{5}$ of a crowne, I turne the crowne into halfe pence, as you willed me, which makes 120, which I diuide by 8, my quotient is 15, which taken foure times make 60 ob. Now reſteth me to haue $\frac{4}{7}$ of the $\frac{1}{3}$ part of a crowne, whereof $\frac{1}{3}$ part is 15 ob. the 15 being parted in 5 parts, the quotient is 3, which taken foure times maketh 12 ob. which with my 60 before amounteth to 72. which are then equall to $\frac{1}{3}$, my deſire.

Maſter. I commend you for your diligence, you might haue wrought it thus: either $\frac{1}{3}$ being abreuiated as before I taught, is $\frac{1}{2}$. Now halfe a crowne is 2 ſhillings 6 pence. Now $\frac{4}{7}$ of $\frac{1}{2}$ is a fraction of fractions, which if you do reduce into one entire fraction, as before you haue learned, in ſaying, fiue times 8 is 40, for a new Denominator, and once 4 is 4, for a new Numerator: it maketh $\frac{4}{40}$, and abreuiated alſo make $\frac{1}{10}$. Now the tenth part of a crowne is 6 pence, which put to 2 ſhillings ſix pence, make alſo 3 ſhillings, your deſire.

But now one example more for this rule, and then we ſhall end it. If I haue $\frac{7}{15}$ of a Soueraigne (accounting the Soueraigne 20 ſhillings)

lings) how many shillings is that $\frac{7}{15}$?

Scholar. I must multiply 7 by 20, and that maketh 140, which I shall divide by 15, and the quotient will be $9\frac{5}{15}$, or else in lesser terms $9\frac{1}{3}$.

Master. That is 9 shillings, and one third part of a shilling, that is 4 pence, as by the same Rule you may prove. And this for this time shall suffice for Reduction. And now I will proceed to Addition.

## Addition.

Addition of fractions of one denomination.

*Whensoever you have any Fractions to be added, you must consider whether they bee of one denomination or not, and if they bee of one Denomination, then adde the Numerators together, and set that that amounteth for the Numerator ouer the common Denominator, and so haue you done: The reason is because that such differ little in* Addition *or* Subtraction *from the worke of vulgar denominations, where the denominators be of the number, as* 3 pence *and* 5 pence, *make* 8 pence, *where the* Denomination *is not altered. But if the fractions be not of one* Denomination, *or any of them be mixt of whole numbers and fractions, then must you first reduce them to one* Denomination, *and after adde them. And if they be many, then adde first two of them, and so the summe that doth amount of the Addition, and the third, and then the fourth, &c. if you haue so many.*

Scholar.

Scholar. This ſeemeth eaſie enough, now that I haue already learned to reduce, without which I could neuer haue wrought this. And therefore now I ſee good reaſon, why you did place Reduction before Additiō.

Maſter. It is well conſidered, but yet refuſe not to exerciſe your vnderſtanding of it by an example.

Scholar. Then would I adde firſt $\frac{7}{12}$ with $\frac{5}{12}$, and becauſe the Denominators are like (and ſo needeth no reduction) I adde 7 to 5, which maketh 12, and then is my ſumme $\frac{12}{12}$, that is in ſmaller numbers, being abbreuiated $\frac{1}{1}$.

To adde fractions of diuers denominations.

And if I haue many numbers to bee added as heere $\frac{1}{8}, \frac{4}{5}, \frac{9}{10}$, firſt I muſt reduce them (becauſe they haue diuers denominators) into one Denomination, and then they will be thus: $\frac{150}{400}, \frac{320}{400}, \frac{360}{400}$, or in leſſer termes, $\frac{15}{40}, \frac{32}{40}, \frac{36}{40}$, which by Addition doe make $\frac{83}{40}$, that is $20\frac{3}{40}$.

Maſter. Now may we goe to Subtraction.

# Subtraction.

*Subtraction hath the same precepts that Addition had, for if the Denominators be like, then must you subtract the one Numerator from the other, and the rest is to bee set ouer the common Denominator, and so your Subtraction is ended: but and if you haue many fractions to be subtracted out of many, then must you reduce them to one Denomination, and into two seuerall fractions, that is, all that must be subtracted into one fraction, and the residue into another fraction, and then worke as I said before.*

Subtraction of fractions.

Scholar. For the first example, I take $\frac{15}{17}$ to be subtracted out of $\frac{17}{17}$ and the rest will bee $\frac{2}{17}$ or $\frac{1}{8}$.

For another example, I take $\frac{3}{4}$ to be subtracted out of $\frac{7}{8}$, which I must reduce, and it will be thus: $\frac{24}{32}$ and $\frac{28}{32}$.

Then doe I subtract 24 out of 28, and there resteth 4, which I set ouer the common Denominator for a Remainer, thus: $\frac{4}{32}$, that is $\frac{1}{8}$.

Now for the third example, I take $\frac{1}{4}$ and $\frac{1}{6}$ to be subtracted from $\frac{7}{8}$ and $\frac{9}{10}$: and because their Denominators bee diuers, I doe reduce them into one denomination thus: $\frac{1440}{1920}$ $\frac{1600}{1920}$, $\frac{1728}{1920}$ $\frac{1520}{1920}$.

Then doe I adde the two first, & they make $\frac{3040}{1920}$. Also I adde the two last, and they yeeld $\frac{3408}{1920}$. Then doe I subtract 3040 out of 3408, and there resteth 368, so is the remainer $\frac{368}{1920}$ that is in smaller termes $\frac{23}{120}$. And thus haue I done with Subtraction, except you haue any more to teach me.

Master. Proue one example or more of two fractions of diuers denominations.

Scholar. I take the two fractions, $\frac{7}{8}$ to be subtracted from $\frac{9}{24}$, which being reduced, will stand thus: $\frac{168}{192}$ and $\frac{72}{192}$. Now would I subtract 168 out 72, but I cannot.

| | | |
|---|---|---|
| | 168 | 72 |
| | $\frac{7}{8}$ | $\frac{9}{24}$ |
| | 192 | |

Master. Then may you perceiue that you misstoke the fractions: for you can neuer subtract the greater out of the lesser, although you may adde multiply, or diuide the greater with the lesser. And albeit that $\frac{7}{8}$ hath both his termes lesser then $\frac{9}{24}$ yet is $\frac{9}{24}$ the leſſer fraction: for generally if you multiply the Numerator and the Denominaters of two fractions crossewaies, that Fraction is the greatest of whose Numerator commeth the greatest summe, as in this example: 7 multiplied by 24. maketh 168: and 9 being multiplied by 8, yeeldeth but 72, therefore is the first fraction 7, the greatest of these two, so can you not subtract it out of a lesser fraction.

The greatest of two fractions.

But if you should subtract a fraction out of a whole number, what should you doe?

Scholar.

Scholar. Marry I would reduce the whole number into a fraction of the same Denomination that my fraction is, and then worke by Subtraction.

Maister. So may you doe, but it is much easier, if your fraction bee a proper fraction, that is to say, lesse then an vnite, to take an vnite from the whole number, and then turne it into an improper fraction, and so worke your Subtraction. As if I would subtract $3\frac{2}{3}$ from 4, I may take 1 from 4, and turne it into $\frac{3}{3}$, from which I abate $3\frac{2}{3}$, there will remaine $\frac{1}{3}$. And if the first fraction be an improper fraction, then may I take so many vnites from the whole number, that they may make an improper fraction greater then that first, and then worke by Subtraction. As if there bee proponed $\frac{10}{3}$ to be subtracted from 6, because $\frac{10}{3}$ is more then 3, and not so much as 4, I must take 4 from 6, & turne them into thirds thus $\frac{12}{3}$, then abate $\frac{10}{3}$, and from $\frac{12}{3}$ there resteth $\frac{2}{3}$: so the whole remainer is $2\frac{2}{3}$. Or else you may at your pleasure take $3\frac{1}{3}$, which is $\frac{10}{3}$, from 6 whole: then set 1 vnder 6, as thus: $\frac{6}{1}$: And then to reduce those two fractions into one Denomination, as here appeareth $\frac{10}{1}$ from $\frac{6}{1}$. Then $\frac{10}{3}$ from $\frac{18}{1}$ resteth $\frac{8}{3}$ which maketh $2\frac{2}{3}$ your desire. And thus will I make an end of the worke of subtraction of fractions, and proceed to multiplication.

8

$\frac{10}{3}$ × $\frac{18}{1}$

3

## Multiplication.

Multiplication of fractions.



*Herefore when any two fractions be proponed to be multiplied together, the Numerater of the one muſt be multiplied by the Numerator of the other: and the ſumme that amounteth thereof muſt be ſet for a new Numerator: likewiſe the Denominater of the one muſt be multiplied by the Denominator of the other, and that that amounteth, ſhall be ſet for the Denominator, and this new third Fraction expreſſeth the product of the multiplication of the two firſt Fractions proponed, whereof take this example, $\frac{3}{5}$ multiplyed by $\frac{5}{12}$, doth make $\frac{15}{60}$*

$\frac{3}{5}$ $\frac{5}{12}$ 15 60

Scholar. I perceiue then that 3, being the Numerator of the firſt fraction, is multiplied by 5, being the numerator of the ſecond fraction, whereof amounteth 15, the numerator of the third Fraction. And ſo likewiſe 5 being the denominator of the firſt fraction, is multiplied by 12 the denominator of the ſecond fraction, whereof amounteth 60 the new denominator ſo that I perceiue how the worke is done, but I do not perceiue how $\frac{15}{60}$ is greater then $\frac{3}{5}$, for if I ſhall vſe my former manner of examination by the parts of ſome coyne, I ſee that $\frac{3}{5}$ of a Crowne is 36 pence, and $\frac{5}{12}$ of a crowne is 25 pence, whereof the one multiplied by the other, doth make

900

900 pence, which is 15 Crownes but by your multiplication there amounteth $\frac{15}{60}$: which is but 15 pence, and that is much leſſe then any other of both the firſt fractions.

Maſter. That difference is betweene multiplication in whole numbers, and multiplication in broken numbers, that in whole numbers, the ſum that amounteth is greater then both the other whereof it came: but in fractions it is contrariwiſe: for the ſumme that amounteth is leſſer then any of the other two fractions whereof it is produced.

Scholar. I deſire much to vnderſtand the reaſon thereof.

Maſter. Although I purpoſed to reſerue the reaſons of workes Arithmeticall for the perfect Booke of Arithmeticke, yet I will ſhew you this, becauſe of the ſtrangeneſſe of the worke.

You ſée in whole numbers, that of two numbers being multiplied together, is made the third number, which third number, doth beare the ſame proportion to the nũber multiplied, that the multiplier doth beare to an vnite. And ſo in fractiõs, the third nũber which amoũteth of multiplication, beareth the ſame proportion to each of the two firſt fractions, that the other of thoſe two fractions doth beare to an Vnite.

Scholar. Sir, I vnderſtand your words thus: when 40 is multiplied by 12, there doth amount 420, which 480 doth containe 40, ſo many times in it, as 12 doth containe Vnites, that is to ſay, twelue times. And ſo it

appeareth that 480 doth containe twelue ſo many times alſo as 40 doth containe vnites, that is 40 times. But now I ſée not how the third number in this example of Fractions can containe any of the two former (as it happened in whole numbers) ſeeing it is leſſer then either of them.

Maſter. No maruell if you cannot ſée that thing which is not poſſible to be ſéene of any man, how the third number in Multiplication of Fractions ſhould be greater then any of the two former fractions: but yet this may you ſée (which I ſaid) that the third number in Fractions ſo multiplied, doth beare the ſame proportion to any of the two former fractions, that the other of thoſe two fractions doth beare to an vnite, as in your example, $\frac{3}{5}$ being multiplied by $\frac{5}{12}$, doth make $\frac{15}{60}$. Now ſay I that $\frac{15}{60}$ doth beare the ſame proportion to $\frac{3}{5}$ that $\frac{5}{12}$ doth beare to an vnite, as you may in your owne forme of examination by Coyne; try it: for in an old Angell, (which in times paſt was current for 7 ſhillings ſixe pence, are 180 halfe pence) which I ſet for the intire vnite, whoſe parts (according to the fractions aforeſaid) are theſe, for $\frac{15}{60}$ ſet 45 halfe pence, for $\frac{3}{5}$ take 108 halfe pence, and for $\frac{5}{12}$ put 75 halfe pence. Now doth 45 beare the ſame proportion to 108, that 75 doth beare to 180, for 45 is $\frac{5}{12}$ of 108, and ſo is 75 alſo $\frac{5}{12}$ of 180.

But theſe reaſons may be better reſerued till another time, when the knowledge of pro-

proportions in due order shall taught: yet in the meane season I will shew you how it commeth to passe, that in fraction the third summe must nèds be lesser then any of the other two.

Consider this, that when a fraction is proponed, as in the former example $\frac{3}{5}$ if it be multiplied by more then 1, it will make more then one entire number. As if I multiply $\frac{3}{5}$ by 5: that is to say, if I take it 5 times, it will make three entire vnites: Example in a Crown, $\frac{3}{5}$ of it maketh 3 shillings, which if I take fiue times. it will amount to 15 shillings, that is, three entire Crownes: so if I take the same $\frac{3}{5}$ but twice, it will yèld 6 shillings, that is, one entire Crowne, and $\frac{1}{5}$. Now if I take it but once, it cannot be more then it was before, that is 5 shillings. And if I take it lesse then once, it cannot bee so much as it was before. Then séeing that a Fraction is lesse then one, if I multiply a fraction by another fraction; it followeth that I doe take the first fraction lesse then once, and therefore the summe that amounteth, must nèds be lesse then the first Fraction. Note. ☜

Scholar. Sir, I thanke you much for this reason. And I trust I doe perceiue the thing, as by example of this same fraction $\frac{3}{5}$ I wil expresse. If I take $\frac{3}{5}$ of a Crowne once, that is to say, if I multiply $\frac{3}{5}$ by 1, it will be as it was before, but 3 shillings: so if I doe multiply it by $\frac{1}{2}$, that is, if I take but halfe one time, then

will it be but halfe so much: likewise if I multiply it by $\frac{1}{3}$, that is, if I take but the third part of one, it will yéeld but 12 pence, that is, the third part of the first Fraction.

And so to make an end: if I take it but the twelfth part of once, that is, If I doe multiply it by $\frac{1}{12}$, it will yéeld but the twelfth part of the first fraction, which is but 3 pence. And it followeth, that if $\frac{1}{12}$ make three pence, then $\frac{5}{12}$ must néeds make fiue times so much, that is 15 pence, which was the summe that hath giuen the occasion of all this doubt.

Master. Then I perceiue you haue sufficient vnderstanding in this sort of multiplication for this time, wherefore I will proceéd to the rest.

To multiply a whole number into a fraction.

*In multiplication it happeneth sometime, that there be whole numbers to be multiplied with Fractions; and may bee in two sorts: for either the whole number is seuerall from the Fraction, and is the Multiplier, or else the whole number is ioyned with one, or both of the Fractions, and so maketh a mixt number thereof. If it bee in the first sort, then needeth there no reduction, but onely multiply the Numerator of the Fraction by that whole number, and the totall thereof set for the new Numerator.*

Scholar. I vnderstand you thus. If I haue $\frac{6}{23}$ to bée multiplied by 16, then must I multiply that 16 with 6, which is the Numerator, whereof commeth 96, and that must I set for the new Numerator, kéeping still 23

for

for the Denominator, and so the fraction will be $\frac{26}{35}$, that is $4\frac{1}{35}$.

Master. And in this sort of worke you may abridge the the labour, thus. If it happen the Denominator to be such a number, as may evenly be divided by the said whole nũber proposed, then divide it thereby, and set the Quotient of that division for the former Denominator, but reserue still the Numerator, and so is the multiplication ended.

Scholar. Then I faine this example $\frac{7}{20}$ to be multiplyed by 5; and because 5 will iustly divide 20, therefore I take the Quotient of that division, which is 4, and set instead of 20, and so the fraction will bee $\frac{7}{4}$, that is $1\frac{3}{4}$.

Master. Which is all one with $\frac{35}{20}$ that would haue followed of the other sort of worke.

Scholar. I perceiue it very well.

Master. *Now then for the other sort, where the number is mixt, take this way: first to reduce the said whole number and fraction into one improper fraction, (as I shewed you in* Reduction *) and then multiply them together, as if they were proper Fractions.* How to Multiply mixt numbers.

Scholar. $13\frac{3}{5}$ being set to bee multiplied by $\frac{5}{8}$ first I must reduce the mixt number, as in this example appeareth by multiplying 13 by 5, and that maketh 65, whereto I must adde the Numerator 3,

$13\frac{3}{5}$ by $\frac{5}{8}$

$\frac{68}{5}$ 40

340

and

and ſo the fraction will be $\frac{68}{5}$, which two Fractions now I ſhall multiply after the accuſtomed forme, and it will be $\frac{340}{40}$ or $\frac{34}{4}$.

Maſter. You haue done well: and ſo may you ſée, that although moſt part of the formes of Multiplication may be wrought without Reduction yet ſome cannot, as namely mixed numbers.

Duplation. *And yet one note more will I tell you of Multiplication, before we leaue it: That is, whenſoeuer you would multiply any Fraction by 2, which commonly is called* Dup'ation, *you may doe it not onely by doubling the Numerator, but alſo by parting the Denominator into halfe, if it be euen.*

Scholar. Then if I would double $\frac{5}{12}$, I may chuſe whether I will make it $\frac{10}{12}$, or elſe $\frac{5}{6}$. And indéed I ſée that is al one, but that the diuiding of the Denominator ſéemeth the better way to make ſmaller termes of the Fraction, and ſo they ſhall néede the leſſe Reduction.

Maſter. It is ſo: and now I ſhall not néed to tell you that multiplication is proued by Diuiſion, and Diuiſion likewiſe by multiplication: but the like worke that I ſhewed you in multiplication, will I ſhew you in Diuiſion alſo.

# Diuiſion of Fractions.

Diuiſion of Fractions.

*Whenſoeuer two Fractions be proponed, that one ſhould bee diuided by the other, I muſt ſet downe firſt the fraction that ſhall be diuided (which is called the Diuidend) and then after it the other which is the Diuiſor. Then ſhall I multiply the Numerator of the Diuidend by the Denominator of the Diuiſor, and that which amounteth, I muſt put for a new Numerator. Againe, I ſhall multiply the Denominator of the Diuidend by the Numerator of the Diuiſor, and the number that amounteth thereof, I muſt put for the new Denominator. And this third Fraction is the Quotient of the ſaid Diuiſion.*

Scholar. This ſæmeth eaſie in forme, as by example thus: If I would diuide $\frac{5}{8}$ by $\frac{2}{6}$, firſt I multiply 5, (being the Numerator of the Diuidend) by 6, which is the Denominator of the Diuiſor, and thereof riſeth 30: then I multiply 8 (being the Denominator of the Diuidend) by 2, being the Numerator in the Diuiſor: and ſo riſeth 16, the which I muſt make in a third Fraction, thus $\frac{30}{16}$.

| | |
|---|---|
| 30 | |
| 5 | 2 |
| 8 | 6 |
| 16 | |

Maſter. Me ſæmeth you are quicker in vnderſtanding now, then you were when I taught

taught you the Art of whole numbers but that is no meruell: for the more knowledge that any man getteth, the readier shall he finde his wit, and quicker in vnderstanding: but yet of two things I will admonish you, which you might haue obserued here for the ease of worke, and lightnesse of vnderstanding, the nature of the Quotient.

Whensoeuer you diuide one fraction by another, either they be both equall together, or else the one is greater then the other: if they be equall, their Quotient shall be such, that the Numerator and the Denominator of it shall be equall also And if the two first fractions be inequall, their Quotient shall declare the same by the vnequality of the Numerator and Denominator, as in these examples following shall appeare.

First, if equall fractions $\frac{4}{9}$ and $\frac{12}{27}$ be equall together, and if the one be diuided by the other the Quotient will be $\frac{108}{108}$, as you may perceiue by that Rule afore said.

Now in the vnequall fractions, as $\frac{4}{9}$ and $\frac{1}{10}$, the Quotient will be $\frac{40}{27}$, where the Numerator is greater then the Denominator.

Scholar. I see it is so: but I see not the reason why it should be so.

Note how to know the proportion betweene two numbers.

Master. The reason is this: When any Fraction is diuided by another, the quotient declareth what proportion the Diuidend beareth to the Diuisor. So $\frac{1}{2}$ diuided by $\frac{1}{2}$ maketh 2, which must be sounded, not 2, but twice,

twice, declaring that $\frac{1}{4}$ is contained twice in $\frac{1}{2}$.

And note this, that the Numerator in the Quotient representeth the Diuidend, and the Denominator representeth the Diuisor. And this is alwayes true, whether the greater fraction be diuided by the lesser, or the lesser by the greater. But this proportion will not be exactly knowne, till you haue learned the Art of proportions: notwithstanding somewhat of it I haue declared in the Rule of Reduction. But now for the easie remembrance of the Quotient in Diuision: as soone as you haue set downe your two fractions the one against the other, then make a straight line for the Quotient: and as soone as you haue multiplied the Numerator of the Diuidend, by the Denominator of the Diuisor, set the number that amounteth ouer the said line, and then multiply the other two numbers, and set their totall vnder the same line.

Scholar. I perceiue you would not haue me trust to memory till I were better expert, lest oftentimes I happen by misse-remembrance to be abused. This example I take for that declaration.

If I would diuide $\frac{2}{3}$ by $\frac{3}{4}$, I must set the numbers one against the other, (as here doth appeare) and then make another line for the quotient in some good distance,

$\frac{2}{3}$ by $\frac{3}{4}$

distance, where I may set the numbers of the quotient, as soone as any of them is multiplied. So then as soone as I haue multiplied 2 by 4, which maketh 8, I shall set that 8 ouer that line, thus: And then multiply 3 by 3, which yeeldeth 9: and that 9 must be set vnder the same line, & then will the whole quotient appeare thus $\frac{8}{9}$: whereby it appeareth (as I remember your words) that $\frac{2}{3}$ is in proportion to $\frac{3}{4}$, as 8 is to 9: but how may I perceiue that?

Master. Although you might better perceiue it by the Rule of Reduction, yet this example may be declared in common coines as in a common shilling of 12 pence, of which $\frac{2}{3}$ maketh 8 pence, and $\frac{3}{4}$ doth make 9 pence, and so you may easily see that their proportions do agree. And if you had taken this example before when you toke the example of $\frac{3}{5}$ and $\frac{2}{6}$ your Quotient would appeare (as this doth) more easie to vnderstand; whereas that Quotient being $\frac{30}{16}$, is not an easie proportion for you to perceiue, being yet little acquainted with proportions.

Scholar. If there be whole numbers to be diuided by a Fraction, how shall I performe it?

To diuide a whole number by a fraction.

Master. *When any whole number shall bee diuided by a Fraction, you must multiply the said whole number with the Denominator of the Fraction, and set the totall thereof for the new* Numerator, *and for the* Denominator set

*set the* Numerator *of the fraction.*

Scholar. Then 20 diuided by $\frac{1}{4}$ will make $\frac{20}{1}$, as here appeareth $\frac{80}{1}$.

| | |
|---|---|
| | 80 |
| $\frac{20}{1}$ by $\frac{1}{4}$ | 3 |

Master. *Euen so: but if you would diuide the fraction by the whole number, then multiply the Denominator by the same whole number, and set the totall for the Denominator, without changing the Numerater.* To diuide the fraction by the whole number.

Master. Then to diuide $\frac{20}{3}$ by 4, it will bee $\frac{20}{12}$, as heere appeareth $\frac{20}{3}$ by $\frac{4}{1}$ in this example $\frac{20}{92}$.

| | |
|---|---|
| | 20 |
| 20 by 4 | |
| 23 1 | |
| | 92 |

Master. You say wel. And by the same example you giue me occasion to remember another briefe way to doe the same: for if you had diuided the said numerator, by 4, and set the quotient for the numerator, keeping still the old denominator, it would haue beene not onely as well done, but also in a fraction of lesser termes. Another briefe way.

Scholar. I guesse it to be euen so, by a like worke that you taught me in multiplication: And for proofe thereof $\frac{20}{3}$ being the diuidend, and 4, the diuisor, I diuide the Numerator 20 by 4, and the quotient is 5, which I set for 20 ouer 23, thus, $\frac{5}{3}$: And I see that it is all one with $\frac{20}{12}$, as by diuiding or abreuiating both these termes by 4, and so reducing them

so

to their least denomination, I may easily proue: as appeareth by this example, $\frac{20}{92}$ $\frac{1}{23}$.

Master. You conceiue it well. And if there be mixt numbers (either one or both) you must first reduce that mixt number into an improper fraction, & then worke as you haue learned.

Scholar. That was sufficiently taught in Multiplication. Therefore I pray you goe forward to some other thing.

Master. Then take this note yet for Diuision: if the denominators be like, then diuide the Numerators as it were in whole numbers, and the quotient whether it be fraction, whole number, or mixt, is a good quotient for that diuision. And generally, if one of the Numerators may iustly diuide the other, by that quotient multiply the Denominator of the lesser Numerator, and set it that doth amount in the roome of the same denominator, and then for a numerator to it, set the Denominator of the other fraction.

Scholar. Then if I would diuide $\frac{3}{4}$ by $\frac{12}{17}$, I see that 3 will diuide 12, and the Quotient will be 4. by which I must multiply the other 4, that is the Denominator vnder 3, and then it is 16, which I set for the denominator 4, and ouer it instead of 3, I must set 17 the other Denominator, and so it is thus, $\frac{17}{16}$.

Master. And so is $\frac{17}{16}$ instead of $\frac{51}{48}$, which would haue risen by the common worke, as here appeareth:

$$\frac{3}{4} \text{ by } \frac{12}{17} \qquad 51 \qquad 48$$

And

*And now for meditation (which is to diuide by 2) marke this, if the Numerator be an euen number, set the halfe of it in his place without the Diuisor, and so haue you done: and if the Numerator be not euen, then double the Denominator.*

Scholar. That is, if I would mediate $\frac{6}{11}$, I may make the quotient $\frac{3}{11}$, and if I would mediate $\frac{7}{11}$ I must make it $\frac{7}{22}$.

Master. And thus will I make an end of the workes of common fractions for this time, not doubting but you can apply them both to the Rule of Progression, and also to the Golden Rule, without any other teaching then you haue learned before, which might seeme tedious to repeat, in regard you haue sufficient knowledge in Reduction, Addition, Subtraction, Multiplication, & Diuision: And therefore will I goe on hand with the Rule of Proportion, or Golden Rule, which now will appeare easie enough.

# The Golden rule direct, in Fractions.

Master.

*Herefore as touching the Golden rule, for the placing of the 3 numbers proponed in the question whereby to find the fourth, and for the forme of their worke, with other like notes, I refer*

The rule of proportion, in fractions.

*refer you to that which you haue already learned.*

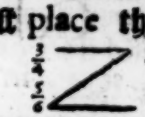
But this eaſie forme of worʒking by fractions ſhall you note, that if your three numbers be fractions, foʒ an apt worʒke and certaine, multiply the numerator of the firſt number in the queſtion, by the denominator of the ſecond: And all that againe multiply by the Denominator of the third number, and the totall thereof ſhall you kéepe foʒ to be the Diuiſor. Then multiply the Denominator of the firſt number by the numerator of the ſecond, and the whole thereof by the Numerator of the third, and the totall thereof ſhall be your Diuidend.

Note this for a generall rule.

Now diuide this Diuidend by the diuiſor which you found out beforʒe, and that number ſhall be the fourth number of the queſtion which you ſéeke foʒ, as in this example.

Aqueſtion of veluet. *If $\frac{3}{4}$ of a yard of veluet coſt $\frac{2}{3}$ of a Soueraigne, eſteemed at* 20 ſhillings, *what ſhall $\frac{5}{6}$ coſt?*

Scholar. If it place you to let mee make the anſwer, I would firſt place theſe three nũbers as I learned in whole numbers, thus.



And then accoʒding to your new rule, I muſt multiply 3, being Numerator, in the firſt number, by 3 the Denominator of the ſecond: and thereo commeth 9, which I multiply againe by 6, the denominator of the third number, and ſo haue I 54, which I kéepe foʒ the diuiſor. Then multiply I 4 the denominator of the firſt, by 2 the numerator of the ſecond,

and

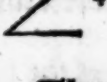
and there ariſeth 8, which againe I multiply by 6, the Numerator of the third, and it maketh 40. Then muſt I diuide 40 by 54, and it will be $\frac{40}{54}$ that is $\frac{20}{27}$, in leſſer termes, and then the Figure will ſtand thus.



But what that is in money I cannot tell, except I ſhall worke it by Reduction, as you taught me.

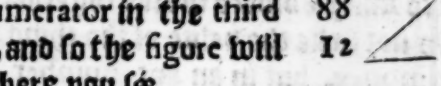
Maſter. It forceth not now, you may reduce it when you liſt, but it were diſorderly done here to mingle diuers works together, where we do not ſeeke the value of the thing in common money, but in an apt number, which ye haue well done. And therefore will I yet ſhew you another like way of eaſineſſe in worke, how you may change your three fractions into three whole numbers, by which you ſhall worke, as if the queſtion were proponed in whole numbers. The firſt number you ſhall find as I taught you: now to find the diuiſor of the ſecond number, take the Numerator for the ſecond fraction: and for the third number take that that ariſeth of the multiplication of the denominator of the firſt, by the numerator of the third, and then worke your queſtion.

Scholar. *For example hereof, I put this queſtion. If* $\frac{11}{13}$ *of* 1 pound *weight of ſilver be worth* $\frac{1}{4}$ *of a Soueraigne, what is* $\frac{1}{2}$ *of* 1 pound *weight worth?* A queſtion of Siluer.

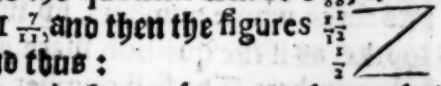


*For the anſwer, firſt I place the fractions in order thus:*

Then to turne these fractions into whole numbers, I multiply 11, which is the numerator of the first by 4 (the denominator of the second) and there commeth 44, which I multiply by 2 the denominator of the third, and so amounteth 88, which I set for the diuisor in the first place. Then in the second place I set 12 which is the numerator of the second fraction, & in the third place I set the sum that amounteth of 12, being the denominator of the first number, multiplied by one, being numerator in the third number, and so the figure will stand as here you see.




Then to worke it forth, I multiply 12 by 12, and there amounteth 144, which I diuide by 88, and the quotient will be $1\frac{56}{88}$, or in lesser termes, $1\frac{7}{11}$, and then the figures will stand thus:




Master. These two formes now you vnderstand well enough, and as for any other at this time I will not repeat, onely this shall you marke for the proofe of this Rule whether your worke be well wrought or no. Multiply the first number by the fourth, and note what amounteth: then multiply the second by the third, and marke what amounteth also. Now if those two numbers so amounting be equall, then is your worke well done, else you haue erred. And this shall suffice for the former rule.

The proof of the golden Rule.

The

# The Backer Rule, or Reuerse Rule in Fractions.

BVt in the Backer Rule, this shall you note for ease of worke, that you multiply the numerator of the first by the numerator of the second, and the whole thereof by the denominator of the third, and that amounteth thereof, shall be the diuidend. Then multiply the denominator of the first, by the denominator of the second, and that whole by the numerator of the third, and that that ariseth thereof, shall bee the diuisor. Example of this.

The backer Rule in Fractions.

Note this also for a generall Rule.

*I did lend my friend* $\frac{3}{4}$ *of a Porteguise seuen moneths, vpon promise that he should do as much for me againe, and when I should borrow of him, he could lend me but* $\frac{5}{12}$ *of a Porteguise: now I demand how long time must I keepe his mony in iust recompence of my loane, accounting* 13 *moneths in the yeare?*

A question of Loane.

Scholar. The first number must be the first mony borrowed, that is $\frac{3}{4}$ of the Porteguise: the second number the 7 moneths, that is $\frac{7}{13}$ of a yeare: and the third number the money that was lent in recompence, that is $\frac{5}{12}$ of a Porteguise: then I set the numbers thus:

$$\frac{3}{4} \quad \frac{7}{13} \quad \frac{5}{12}$$

Then (as you taught mée) I multiply 3 (being numerator in the firſt number by 7, the numerator of the ſecond number, and it maketh 21, which I multiply by 12 the denominator of the third, and ſo haue I 252 for the diuidend: then I multiply 4 the denominator of the firſt, by 13 the denominator of the ſecond, & it yéeldeth 52, which I multiply againe by 5 the numerator of the third, and it will make 260, that is the diuiſor. Then muſt I diuide 252 by 260, ſo it will be in the ſmall fraction $\frac{63}{65}$ of a yeare.

Maſter. And thus do you ſée ſome eaſe in working, better then to multiply and diuide tediouſly ſo many Fractions.

Statute of Aſſiſe of Bread and Ale.

*Another queſtion yet will I propoſe, to the intent you may ſee thereby the reaſon of the Statute of aſſiſe of bread and ale, which in all ſtatute Books, in Latine, French and Engliſh is much corrupted for want of knowledge in this Art, for the right vnderſtanding whereof, I propone this queſtion.*

Queſtion of Bread.

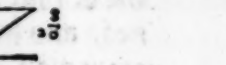
*When the price of a quarter of Wheat is* 2 ſhillings, *the farthing white loafe ſhall weigh* 68 ſhillings, *then I demand what ſhall ſuch a loafe weigh when a quarter of Wheat is ſold for* 3 ſhillings?

Scholar. This queſtion muſt be wrought as it is propoſed in whole numbers, and not in Fractions.

Maſter. You ſéeme to ſay reaſonably, howbeit in the Statute of aſſiſe, the rate is made by

by the proportion of parts in a pound waight Troy, else could it not be a Statute of any long continuance, seeing the shillings doe change often, as all other monies doe: but this statute being well understood, is a continuall rule for ever, as I will anon declare by a New Table of Assise, converting the shillings into ounces, and parts of ounces.

Wherefore here by a shilling you must understand $\frac{1}{20}$ of a pound waight, and so by a penny $\frac{1}{240}$ of an ounce: wherefore although you might worke this question proponed by whole numbers well enough, for that time when the Statute was made, yet to apply it to your time, and to make it serue for all times generally, it is best to worke it by fractions, setting for 2 shillings $\frac{2}{20}$, and for 68 shillings, $\frac{68}{20}$, & so for three shillings $\frac{3}{20}$, and then will the Figure of the question stand thus.



In which question because all the denominators bee like, you shall worke onely with the numerators.

Scholar. Then shall I multiply 68 by 2, whereof commeth 136, which if I diuide by 3, the quotient will be $45\frac{1}{3}$: but how shall I make a fraction of that, to stand with the other?

Master. Haue you so soone forgotten what was taught you so lately? this is his forme.

$$\frac{45\frac{1}{3}}{20}$$

Scholar. I remember it now, and then it signifieth 45 twenty parts, and the third deale of one twenty part.

Note what a shilling is.

Master. So is it that maketh in shillings 45 shillings 4 pence, whereby you may note one great error in the Statute Bookes, which haue constantly 48 shillings in that Assise. And by this Rule if you examine the Statute, you shall find many summes false. Wherefore for the true vnderstanding of that Statute, and such like as I haue made mention of it, and somewhat recognised it, so do I wish that all Gentlemen & other Students of the Lawes would not neglect this Art of Arithmeticke, as vnnedfull to their studies. Wherefore to encourage them thereto, and to gratifie both them and all other in generall, I will exhibite a Table of that part of the Statutes in two columnes, and in a third columne. I will adde the correction of those errors which haue crept into it.

Here followeth the Table.

The

| The price of a quarter of Wheate | | The waight of a farthing waight loafe by the Statute Bookes. | | | The Correction by iuſt Aſſiſe. | | |
|---|---|---|---|---|---|---|---|
| s | d | l | s | d | l | s | d |
| 1 | 0 | 6 | 16 | 0 | 6 | 16 | 0 |
| 1 | 6 | 4 | 10 | 8 | 4 | 10 | 8 |
| 2 | 0 | 2 | 8 | 0 | 3 | 8 | 0 |
| 2 | 6 | 2 | 14 | 4 4/5 | 2 | 14 | 4 4/5 |
| 3 | 0 | 2 | 8 | 0 | 2 | 5 | 4 |
| 3 | 6 | 2 | 2 | 0 | 1 | 18 | 10 2/7 |
| 4 | 0 | 1 | 16 | 0 | 1 | 14 | 0 |
| 4 | 6 | 1 | 10 | 0 | 1 | 10 | 2 2/7 |
| 5 | 0 | 1 | 8 | 2 1/3 | 1 | 7 | 2 8/11 |
| 5 | 6 | 1 | 4 | 8 1/4 | 1 | 4 | 8 2/11 |
| 6 | 0 | 1 | 2 | 8 | 1 | 2 | 8 |
| 6 | 6 | 1 | 0 | 11 | 1 | 0 | 11 1/11 |
| 7 | 0 | 0 | 19 | 1 | 0 | 19 | 5 1/7 |
| 7 | 6 | 0 | 18 | 1 1/5 | 0 | 18 | 1 3/5 |
| 8 | 0 | 0 | 17 | 0 | 0 | 17 | 0 |
| 8 | 6 | 0 | 16 | 0 | 0 | 16 | 0 |
| 9 | 0 | 0 | 15 | 0 1/4 | 0 | 15 | 1/2 |
| 9 | 6 | 0 | 14 | 0 3/4 | 0 | 14 | 3 5/19 |
| 10 | 0 | 0 | 13 | 7 1/2 | 0 | 13 | 7 3/7 |
| 10 | 6 | 0 | 12 | 11 1/4 | 0 | 12 | 11 3/7 |
| 11 | 0 | 0 | 12 | 4 1/4 | 0 | 12 | 4 4/11 |
| 11 | 6 | 0 | 11 | 10 | 0 | 11 | 9 2/11 |
| 12 | 0 | 0 | 11 | 4 | 0 | 11 | 4 |

*In the common Bookes there is no further rate of Assise made, then into 12 s the quarter of Wheat, but in an antient Copy of 200 yeres old (which I haue) there is added the rate of Assise vnto 20 s the quarter, but yet was that assise also either wrong cast at the first penning, or else corrupt since that time, for lack of iust knowledge in the Rule of Proportion, which I will adde here also to gratify such as be desirous to vnderstand truth exactly.*

| The price of a quarter of Wheate | | The waight of a farthing white loafe by the Statute Bookes. | | | The Correction by iuft Affife. | | |
|---|---|---|---|---|---|---|---|
| s | d | l | s | d | l | s | d |
| 12 | 6 | 0 | 11 | 0 | 0 | 10 | $10\frac{14}{51}$ |
| 13 | 0 | 0 | 11 | $0\frac{1}{2}$ | 0 | 10 | $5\frac{7}{13}$ |
| 13 | 6 | 0 | 10 | $1\frac{1}{3}$ | 0 | 10 | $0\frac{8}{9}$ |
| 14 | 0 | 0 | 9 | 7 | 0 | 9 | $8\frac{4}{7}$ |
| 14 | 6 | 0 | 9 | $2\frac{1}{3}$ | 0 | 9 | $4\frac{16}{39}$ |
| 15 | 0 | 0 | 9 | $1\frac{1}{2}$ | 0 | 9 | $0\frac{4}{7}$ |
| 15 | 6 | 0 | 9 | $1\frac{1}{4}$ | 0 | 8 | $9\frac{9}{31}$ |
| 16 | 0 | 0 | 9 | 0 | 0 | 8 | 6 |
| 16 | 6 | 0 | 8 | 6 | 0 | 8 | $2\frac{10}{17}$ |
| 17 | 0 | 0 | 8 | 3 | 0 | 8 | 0 |
| 17 | 6 | 0 | 7 | 10 | 0 | 7 | $10\frac{9}{51}$ |
| 18 | 0 | 0 | 7 | 6 | 0 | 7 | $6\frac{2}{3}$ |
| 18 | 6 | 0 | 7 | 3 | 0 | 7 | $4\frac{4}{17}$ |
| 19 | 0 | 0 | 7 | 2 | 0 | 7 | $1\frac{17}{19}$ |
| 19 | 6 | 0 | 5 | 10 | 0 | 6 | $11\frac{9}{13}$ |
| 20 | 0 | 0 | 5 | 6 | 0 | 6 | $3\frac{3}{5}$ |

These two Tables I haue set seuerall, because no man should thinke that I would either adde or take away from any Law those parts which might of right seeme either superfluous, either diminute: but yet I may not be so curious as to neglect manifest errours, which is not onely my part, but euery good Subiects duty with sobriety to correct. And for auoiding of offence, I haue rather done it in this Priuate Booke, then in any Booke of the Statutes it selfe, trusting that all Men will take it in good part.

Scholar. I would wish so, but I dare not so hope, sith neuer good man that would reforme errour, could escape the venimous tongues of enuious detracters, which because they either cannot, or list not to doe any good themselues, do delight to barke at the doings of other, but I beseech you to stay nothing for their peruerse behauiour.

Master. I consider many things that some may obiect, whereunto I am not vnprouided of iust answers, but I will not seeme so hasty to make the answers, before I heare their obiections, but as I trust that men are of a better nature, and more gratefull now then some haue beene in times past, as I haue done in the Statute of Assise for bread in rate of shillings, so will I set forth the like Table in pounds and ounces, and the parts thereof, that it may be easily applied to all times: but I meane not by this to alter any word of the Statute,

Concerning the following Tables.

Statute, being ſo good an ordinance, and of ſo great continuance) but onely to make it as a kinde of expoſition and declaration of the ſaid Statute, truſting that thereby the Statute may be better vnderſtood, and conſequently better put in execution. And here you ſhall note, that I haue accounted the ſhillings after the rate of 60 ſhillings to the pound weight, becauſe I eſteeme it the moſt apt for our time. Wherefore in the firſt Columne you finde the price of Wheat directly againſt it; in the ſecond Columne, you may finde the weight of a Farthing white Loafe in this our time: and if you double the number (as I haue done in the third Columne) then haue you the weight of the Halfe-penny White-Loafe; and ſo in the fourth Columne is ſet the weight of a penny white-Loafe. It needeth not to tell that the ſight doth teſtifie, how that euery Columne is parted into three ſmaller pillars, whereof the firſt Columne hath theſe three titles; pounds, ounces, and penny weights. And as in the firſt columne 12 pence make a ſhilling, and 20 ſhillings make a pound, ſo in the other three Columnes 20 pence weight maketh an ounce and 12 ounces do make a Pound.

A pound weight.

Gentle

*Gentle Reader*, touching the vnderſtanding of the *Table* following, wherein according to our time, *Maſter Record* alloweth 60 *pence* to the *ounce*, and 3 *pound*, or 60 *ſhillings* to the *pound*, and thereupon after the rate of 60 *ſhillings* to the *pound Troy*, doth he frame or produce this his *Table*, beginning at 3 *ſhillings the quarter*, till he comes to 40 *ſhillings* 6 *pence the quarter*. And this his *proportion* (for that he hath not ſet downe any one *Example* to continue the worke) hath beene hard for many to conceiue or comprehend, and therefore the only chiefe cauſe why I haue written this *digreſſion* for the better vnderſtanding of him therein.

The firſt thing therefore that is ſought for in this *Table*, as in the other aforeſaid, is a *Maxime*, grounded vpon the *Statute*, which is this. When the *quarter of Wheat* is ſold for *two ſhillings*, then the *farthing white-loafe* ſhall weigh 68 *ſhillings*, whereby *a ſhilling* is meant $\frac{1}{12}$ of a *pound*, and by a *penny* $\frac{1}{20}$ of an *ounce*. Now therefore for a *generall Rule*, to finde what weight the *Farthing-white-loafe* ſhall weigh at 3 *ſhillings the quarter*, till you come to 40 *ſhillings* 6 *pence the quarter*, is thus to be wrought. Comming to the *firſt ground*, and working by the *Backer Rule*, ſay; if *two ſhillings the quarter*, giue, or allow the *Farthing-white-loafe* to wey 68 *ſhillings*, what weight ought the *Farthing-white-loafe* to weigh at 3 *ſhillings the quarter*? Worke, and you ſhall find 45 *ſhillings*, 4 *pence*,

as before in the correction of the *firſt Table* is noted. Then for the *ſecond worke*, ſay by the *Rule of 3 direct*; if 20 *pence* giue one *ounce*, what giueth 45 *ſhillings*, 4 *pence*? Multiply and diuide, and you ſhall finde 544 *ounces*, which 544 *ounces* being multiplied by 3, for 3 *pounds*, or 60 *ſhillings*, yeeldeth 1632 *ounces*, which diuided by 20, produceth 81 *ounces*, and $\frac{12}{20}$, or rather $\frac{3}{5}$ of an *ounce*, equall vnto 12 *penny weight*, which is *halfe an ounce*, and 2 *penny weight*, and ſo maketh in all 6 *pounds*, 9 $\frac{1}{2}$ *ounces*, and 2 *penny weight*. Now the next way to continue this *Table*, to know the weight of the *Halfe-penny White-loafe*, is thus. Multiply 1632 *ounces* by 2, and it bringeth forth 3264 *ounces*, and diuided by 20, it yeeldeth 163 *ounces* and $\frac{4}{5}$, which is equall to 13 *pounds*, 7 *ounces*, and 4 *penny weight*, as *M. Record his Table noteth*.

*Thirdly, for the weight of the Penny White-loafe*, multiply 1632 *ounces* by 4, and diuide by 20, and after by 12, as before, and you ſhall find 27 *pounds*, 2 *ounces*, and 8 *penny weight*, &c. This *Method*, or elſe by doubling the *Farthing white-loafe*, for the *weight of the Halfe-penny white-loafe*, and ſo doubling the *halfe-penny White-loafe*, for the *weight* of the *Penny White-loafe*, is the order to continue the *Table* to the end thereof.

The

The price of a quarter of Wheat.

| po. | shil. | pe. |
|---|---|---|
| 0 | 3 | 0 |
| 0 | 4 | 6 |
| 0 | 6 | 0 |
| 0 | 7 | 6 |
| 0 | 9 | 0 |
| 0 | 10 | 6 |
| 0 | 12 | 0 |
| 0 | 13 | 6 |
| 0 | 15 | 0 |
| 0 | 16 | 6 |
| 0 | 18 | 0 |
| 0 | 19 | 6 |
| 1 | 1 | 0 |
| 1 | 2 | 6 |
| 1 | 4 | 0 |
| 1 | 5 | 6 |
| 1 | 7 | 0 |
| 1 | 8 | 6 |
| 1 | 10 | 0 |
| 1 | 11 | 6 |
| 1 | 13 | 0 |
| 1 | 14 | 6 |
| 1 | 16 | 0 |
| 1 | 17 | 6 |
| 1 | 19 | 0 |
| 2 | 0 | 6 |

The waight of a farthing white loafe.

| po. | oũ. | penny. waight. |
|---|---|---|
| 6 | 9 | 12 |
| 4 | 6 | 8 |
| 3 | 4 | 16 |
| 2 | 8 | $12\frac{4}{5}$ |
| 2 | 3 | 4 |
| 1 | 11 | $6\frac{1}{7}$ |
| 1 | 8 | 8 |
| 1 | 6 | $2\frac{2}{3}$ |
| 1 | 4 | $6\frac{2}{5}$ |
| 1 | 2 | $16\frac{8}{11}$ |
| 1 | 1 | 12 |
| 1 | 0 | $11\frac{1}{13}$ |
| 1 | 0 | $4\frac{4}{5}$ |
| 0 | 10 | $17\frac{3}{5}$ |
| | 10 | 4 |
| | 9 | 12 |
| | 9 | $1\frac{1}{3}$ |
| | 8 | $11\frac{13}{19}$ |
| | 8 | $3\frac{1}{5}$ |
| | 7 | $15\frac{3}{7}$ |
| | 7 | $8\frac{4}{7}$ |
| | 7 | $1\frac{11}{23}$ |
| | 6 | 16 |
| | 6 | $10\frac{14}{25}$ |
| | 6 | $5\frac{7}{13}$ |
| | 6 | $0\frac{2}{25}$ |

The price of a quarter of Wheate.

| £ | s | d |
|---|---|---|
| 0 | 3 | 0 |
| 0 | 4 | 6 |
| 0 | 6 | 0 |
| 0 | 7 | 6 |
| 0 | 9 | 0 |
| 0 | 10 | 6 |
| 0 | 12 | 0 |
| 0 | 13 | 6 |
| 0 | 15 | 0 |
| 0 | 16 | 6 |
| 0 | 18 | 0 |
| 0 | 19 | 6 |
| 1 | 1 | 0 |
| 1 | 2 | 6 |
| 1 | 4 | 0 |
| 1 | 5 | 6 |
| 1 | 7 | 0 |
| 1 | 8 | 6 |
| 1 | 10 | 0 |
| 1 | 11 | 6 |
| 1 | 13 | 0 |
| 1 | 14 | 6 |
| 1 | 16 | 0 |
| 1 | 17 | 6 |
| 1 | 19 | 0 |
| 2 | 0 | 6 |

The weight of a Halfe-penny white loafe.

| po. | ounces. | penny waight. |
|---|---|---|
| 13 | 7 | 4 |
| 9 | 0 | 16 |
| 6 | 9 | 12 |
| 5 | 5 | $5\frac{1}{5}$ |
| 4 | 6 | 8 |
| 3 | 10 | $12\frac{4}{7}$ |
| 3 | 4 | 16 |
| 3 | 0 | $1\frac{1}{3}$ |
| 2 | 8 | $12\frac{4}{5}$ |
| 2 | 5 | $13\frac{5}{11}$ |
| 2 | 3 | 4 |
| 2 | 1 | $2\frac{3}{13}$ |
| 2 | 0 | $9\frac{3}{5}$ |
| 1 | 9 | $15\frac{1}{3}$ |
| 1 | 8 | 8 |
| 1 | 7 | 4 |
| 1 | 6 | $2\frac{2}{3}$ |
| 1 | 5 | $3\frac{11}{19}$ |
| 1 | 4 | $6\frac{2}{5}$ |
| 1 | 3 | $10\frac{6}{7}$ |
| 1 | 2 | $16\frac{8}{11}$ |
| 1 | 2 | $3\frac{19}{33}$ |
| 1 | 1 | 12 |
| 1 | 1 | $1\frac{3}{35}$ |
| 1 | 0 | $11\frac{1}{13}$ |
| 1 | 0 | $0\frac{4}{45}$ |

The waight of a Penny white loafe.

| po. | ounces. | penny waight. |
|---|---|---|
| 27 | 2 | 8 |
| 18 | 1 | 12 |
| 13 | 7 | 4 |
| 10 | 10 | $11\frac{1}{7}$ |
| 9 | 0 | 16 |
| 7 | 9 | $5\frac{1}{7}$ |
| 6 | 9 | 12 |
| 6 | 0 | $10\frac{1}{7}$ |
| 4 | 5 | $5\frac{3}{7}$ |
| 4 | 11 | $6\frac{10}{11}$ |
| 4 | 6 | 8 |
| 4 | 2 | $4\frac{4}{13}$ |
| 3 | 0 | $19\frac{1}{7}$ |
| 3 | 7 | $10\frac{3}{7}$ |
| 3 | 4 | 16 |
| 3 | 2 | 8 |
| 2 | 0 | $5\frac{1}{8}$ |
| 2 | 10 | $7\frac{3}{13}$ |
| 2 | 8 | $12\frac{4}{7}$ |
| 2 | 7 | $1\frac{3}{7}$ |
| 2 | 5 | $13\frac{5}{11}$ |
| 2 | 4 | $7\frac{15}{33}$ |
| 2 | 3 | 4 |
| 2 | 2 | $2\frac{6}{35}$ |
| 2 | 1 | $2\frac{3}{13}$ |
| 2 | 0 | $0\frac{8}{45}$ |

HAning ſpoken before for the vnderſtanding of the *Table* placed by *M. Record*, a man indued with rare knowledge in *Arithmeticall and Geometricall proportions*, touching the *Statute* of *Coynage*, *and the Standard thereof*, as appeareth in his Epiſtle of this *Booke, dedicated to King Edward the ſixt.* inſinuating vnto his Higneſſe that the *Standard of Coyne* is much altered from the 14 yeere of *King Edward the third*, (when this *Statute and Aſſiſe* was confirmed) to the *Standard of this our time*. For it appeareth that in *King Edward the thirds* time, when the *Aſſiſe of Bread and Drinke* was eſtabliſhed, that a *Sterling peny, round without clipping*, did then weigh 32 *cornes of wheat dry*, and taken out of the middle of the *eare*, and 20 of theſe *pence* made an *ounce*, & 12 *ounces* made a *pound Troy*. And ſo from the *weight of a peny* to 20 *ſhillings ſterling*, which then weighed 12 *ounces*, tooke *Bread his weight* and proportion: And now finding 60 *pence* is an *ounce*. That onely cauſe (I perceiue, for the zeale of a Commonweith) mooued him to ſet downe the ſame *Table in this priuate Booke*; meaning not thereby to alter any word of the *Statute* being ſo good an ordinance and of ſo long continuance, but as a kinde of expoſition by the way, that thereby the *Statute* may be better vnderſtood, and ſo conſequently better put in execution. Which *Aſſiſe of bu*, is three times greater then the *Statute* now alloweth. Therefore alſo, (to gratifie ſuch as are deſirous of knowledge, according to theſe *prices of a Quarter of wheate*) I haue added to this *Author theſe three other new Tables following*, and reduced their *prices* into their iuſt proportions of *Sterling money*, and alſo reduced the *Mony* into knowne *weight Troy*, according to the *Statute*. And thereafter according to proportion in my other three *Tables*, haue I noted the *iuſt weight* that a *Farthing, Halfe peny, and Peny white Loafe* ought to weigh by the *Statute*.

The price of a quarter of Wheate.

| l. | s. | d. |
|---|---|---|
| 0 | 3 | 0 |
| 0 | 4 | 6 |
| 0 | 6 | 0 |
| 0 | 7 | 6 |
| 0 | 9 | 0 |
| 0 | 10 | 6 |
| 0 | 12 | 0 |
| 0 | 13 | 6 |
| 0 | 15 | 0 |
| 0 | 16 | 6 |
| 0 | 18 | 0 |
| 0 | 19 | 6 |
| 1 | 1 | 0 |
| 1 | 2 | 6 |
| 1 | 4 | 0 |
| 1 | 5 | 6 |
| 1 | 7 | 0 |
| 1 | 8 | 6 |
| 1 | 10 | 0 |
| 1 | 11 | 6 |
| 1 | 13 | 0 |
| 1 | 14 | 6 |
| 1 | 16 | 0 |
| 1 | 17 | 6 |
| 1 | 19 | 0 |
| 2 | 0 | 6 |

The weight of a Farthing white loafe in Sterling mony by aſſiſe.

| l. | s. | d. |
|---|---|---|
| | 2 | 5 | 4 |
| | 1 | 10 | $2\frac{2}{3}$ |
| | 1 | 2 | 8 |
| | 0 | 18 | $1\frac{3}{5}$ |
| | 0 | 15 | $1\frac{1}{2}$ |
| | 0 | 12 | $15\frac{3}{7}$ |
| | 0 | 11 | 4 |
| | 0 | 10 | $0\frac{8}{9}$ |
| | 0 | 9 | $0\frac{4}{5}$ |
| | 0 | 8 | $2\frac{10}{11}$ |
| | 0 | 7 | $6\frac{2}{3}$ |
| | 0 | 6 | $11\frac{9}{13}$ |
| | 0 | 6 | $9\frac{3}{5}$ |
| | 0 | 6 | $0\frac{8}{13}$ |
| | 0 | 5 | 8 |
| | 0 | 5 | 4 |
| | 0 | 5 | $0\frac{4}{9}$ |
| | 0 | 4 | $9\frac{5}{19}$ |
| | 0 | 4 | $6\frac{2}{7}$ |
| | 0 | 4 | $3\frac{17}{21}$ |
| | 0 | 4 | $1\frac{1}{11}$ |
| | 0 | 3 | $11\frac{1}{23}$ |
| | 0 | 3 | $9\frac{3}{3}$ |
| | 0 | 3 | $7\frac{13}{21}$ |
| | 0 | 3 | $5\frac{11}{13}$ |
| | 0 | 3 | $4\frac{8}{17}$ |

The waight of a Farthing white loafe in Troy weight by Aſſiſe.

| ounc. | po. | penny waight. |
|---|---|---|
| 2 | 3 | 4 |
| 1 | 6 | $2\frac{2}{7}$ |
| 1 | 1 | 12 |
| 0 | 10 | $17\frac{3}{5}$ |
| | 9 | $1\frac{1}{2}$ |
| | 7 | $15\frac{3}{7}$ |
| | 6 | 16 |
| | 6 | $0\frac{8}{9}$ |
| | 5 | $8\frac{4}{5}$ |
| | 4 | $18\frac{10}{11}$ |
| | 4 | $10\frac{2}{3}$ |
| | 4 | $3\frac{7}{13}$ |
| | 4 | $1\frac{3}{2}$ |
| | 3 | $12\frac{8}{17}$ |
| | 3 | 8 |
| | 3 | 4 |
| | 3 | $0\frac{4}{9}$ |
| | 3 | $17\frac{5}{19}$ |
| | 2 | $14\frac{2}{7}$ |
| | 2 | $11\frac{17}{21}$ |
| | 2 | $9\frac{1}{2}$ |
| | 2 | $7\frac{7}{23}$ |
| | 2 | $5\frac{3}{3}$ |
| | 2 | $3\frac{13}{25}$ |
| | 2 | $1\frac{11}{13}$ |
| | 2 | $0\frac{8}{17}$ |

The price of a quarter of Wheat.

| l. | s. | d. |
|---|---|---|
| 0 | 3 | 0 |
| 0 | 4 | 6 |
| 0 | 6 | 0 |
| 0 | 7 | 6 |
| 0 | 9 | 0 |
| 0 | 10 | 6 |
| 0 | 12 | 0 |
| 0 | 13 | 6 |
| 0 | 15 | 0 |
| 0 | 16 | 6 |
| 0 | 18 | 0 |
| 0 | 19 | 6 |
| 1 | 1 | 0 |
| 1 | 2 | 6 |
| 1 | 4 | 0 |
| 1 | 5 | 6 |
| 1 | 7 | 0 |
| 1 | 8 | 6 |
| 1 | 10 | 0 |
| 1 | 11 | 6 |
| 1 | 13 | 0 |
| 1 | 14 | 6 |
| 1 | 16 | 0 |
| 1 | 17 | 6 |
| 1 | 19 | 0 |
| 1 | 0 | 6 |

The weight of the Half-penny white loafe in Troy weight by Assise.

| po. | oũ. | penny weight |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |

Scholar. Sir, I do thanke you moſt heartily for this, not onely in mine owne name, and in the name of all Students, but alſo in the name of the whole Commons, to whom the reſtitution of this Aſſiſe (I truſt) ſhall bring reſtitution of the weight in Bread, which long time hath béene abuſed. And if you know any like things more, wherein you would vouchſafe to declare the errours, and ſet forth the truth, you cannot but obtaine great thankes of all good hearted men that loue the Common-wealth.

Maſter. I haue ſundry things to declare, but I haue reſerued them for a priuate Booke by it ſelfe, yet notwithſtanding becauſe the Statute of the rate of meaſuring of ground is ſo common, that it toucheth all men, and yet no more common then néedfull, but ſo much corrupt, that is, to farre out of all good rate, not onely in the Engliſh Books of Statutes, commonly printed, but alſo in the Latine Books, and in the French alſo (for I haue read of each ſort, and conferred them diligently) I will giue you a Table for the reſtitution of thoſe errours, as may ſuffice for this preſent time. And firſt I will propoſe one queſtion to you touching the vſe of that Statute, whereby you may perceiue the order how to examine the whole Statute, and euery parcell thereof, and the queſtion is this.

A queſtion of meaſuring of ground.

*When the Acre of ground doth containe foure Perches in breadth, then muſt it containe* 40 *Perches*

*ches in length. Then do I demand of you, how much shall the length of an Acre be, when there is in the breadth of it* 13 *Perches. But before you shall answer to this question, I will declare vnto you another Statute, which is the ground of the former Statute. And that Statute is this.*

It is ordained that three Barly-cornes dry and round, shall make vp the measure of an inch: 12 inches shall make a foot, and 3 foot shall make a yard, (the common English bookes haue an Elne) fiue yards and a halfe shall make a Perch, and 40 Perches in length, and 4 in breadth, shall make an Acre. This is that Statute, whereby you may perceiue, that the intent of the Statute is, that one Acre should containe 160 square Perches. Now let me heare you answer to the question. Statute measure. An Acre.

Scholar. As I perceiue by the words of the Statute, a Perch to be the $\frac{1}{160}$ part of an Acre, so could I make those numbers all in fractions, and so worke the question: but seeing I may doe it also in whole numbers, I take that forme for the most ease; therefore thus I set the question in forme. Then do I multiply 40 by 4, and it maketh 160, which I diuide by 13, and the quotient is $12\frac{4}{13}$.

4 Z 40
13 Z $12\frac{4}{13}$

Master. Now turne that $\frac{4}{13}$ into the common parts of a Perch, as they be named in the former Statute: howbeit it shall be best to take one of the least parts in Denomination

for auoiding of much labour, as Feet, where of the Perch containeth $16\frac{1}{2}$.

Scholar. Then to returne $\frac{4}{13}$ into Feet, I multiply $16\frac{1}{2}$ by 4, and it maketh 66, which I muſt diuide by 13, and the quotient is $5\frac{5}{13}$.

Maſter. So I finde, that if the Acre hold in breadth 13 Perches, it ſhall containe in length 12 Perches, 5 Foot, and $\frac{1}{13}$ of a Foot, which is not fully an Inch, for the Inch is $\frac{1}{12}$ of a Foot. But here all the Statute Books in Latine and Engliſh (that I haue ſeene) do note it to be 13 Perches, 5 Foot, and one Inch, which maketh aboue 13 Perches too many in the Acre: ſo that I would haue thought the errour to haue crept into the Printed Books, by the great negligence that Printers in our time do vſe, ſaue that in written Copies of great antiquitie, I do finde the ſame: yet haue I one French copy which hath 12 Perches $\frac{1}{2}$ and one Foot, and that miſſeth very little of the truth.

Note this errour.

Scholar. Then I ſée it is true that I haue often heard ſay, that the trueſt Copies of the Statutes, be the French Copies.

Maſter. That is often true, but not generally, as I haue by conference tried diuerſly: but in this Statute the French Book is moſt corrupt: in all other places lightly.

But now to performe my promiſe, I will ſet forth the Table for meaſuring of an Acre of ground, onely by ſuch p rts as the Statute doth mention, becauſe at this time I do of purpoſe

purpoſe wꝛite it foꝛ the better vnderſtanding of that Statute, and hereafter with other things intend to ſet foꝛth this ſame moꝛe at large.

*In this Table following, I haue not done as in the other Statute before compared by reſtitution with the faults crept into the Statute, but onely haue written that true meaſure, which the equity of the Statute doth pretend. For it were vile to iudge of ſo noble Princes and worthy Counſellers, as haue authoriſed and ſet forth this Statute, that they would make one Acre in any forme greater then another, but euery one to be iuſt and equall with each other, which is the ground alſo of my worke: and hereby may all men perceiue how needfull Arithmeticke is to the Students of Law. But now I thinke beſt to make an end of theſe matters for this preſent time, ſith the Table hath in it none obſcurity that I ſhould need to declare.*

| The breadth of the Acre | The length of the Acre. | | | |
|---|---|---|---|---|
| Perches. | Perches. | Feete: | Inches: | Parts of an Inch. |
| 10 | 16 | 0 | 0 | 0 |
| 11 | 14 | 9 | 0 | 0 |
| 12 | 13 | 5 | 6 | 0 |
| 13 | 12 | 5 | 0 | $\frac{12}{13}$ |
| 14 | 11 | 7 | 0 | $\frac{6}{7}$ |
| 15 | 10 | 11 | 0 | 0 |
| 16 | 10 | 0 | 0 | 0 |
| 17 | 9 | 6 | 9 | $\frac{9}{17}$ |
| 18 | 8 | 14 | 8 | 0 |
| 19 | 8 | 6 | 11 | $\frac{7}{19}$ |
| 20 | 8 | 0 | 0 | 0 |
| 21 | 7 | 10 | 2 | $\frac{4}{7}$ |
| 22 | 7 | 4 | 6 | 0 |
| 23 | 6 | 15 | 9 | $\frac{9}{23}$ |
| 24 | 6 | 11 | 0 | 0 |
| 25 | 6 | 6 | 7 | $\frac{1}{2}$ |
| 26 | 6 | 2 | 7 | $\frac{6}{13}$ |
| 27 | 5 | 15 | 3 | $\frac{1}{3}$ |

The

| The breadth of the Acre | The length of the Acre. | | | |
|---|---|---|---|---|
| Perches. | Perches. | Feete. | Inches. | Parts of an Inch. |
| 28 | 5 | 11 | 9 | $0\frac{3}{7}$ |
| 29 | 5 | 8 | 6 | $0\frac{12}{29}$ |
| 30 | 5 | 5 | 6 | 0 |
| 31 | 5 | 2 | 7 | $0\frac{29}{31}$ |
| 32 | 5 | 0 | 0 | 0 |
| 33 | 4 | 14 | 0 | 0 |
| 34 | 4 | 11 | 7 | $0\frac{13}{7}$ |
| 35 | 4 | 9 | 5 | $0\frac{1}{7}$ |
| 36 | 4 | 7 | 4 | 0 |
| 37 | 4 | 5 | 4 | $0\frac{8}{37}$ |
| 38 | 4 | 3 | 5 | $0\frac{13}{19}$ |
| 39 | 4 | 1 | 8 | $0\frac{4}{13}$ |
| 40 | 4 | 0 | 0 | 0 |
| 41 | 3 | 14 | 10 | $0\frac{28}{41}$ |
| 42 | 3 | 13 | 4 | $0\frac{2}{7}$ |
| 43 | 3 | 11 | 10 | $0\frac{32}{43}$ |
| 44 | 3 | 10 | 6 | 0 |
| 45 | 3 | 9 | 2 | 0 |

Scholar.

Scholar. Indeed Sir, I vnderstand the Table (as I thinke) by those other which you set forth before. For in the first columne is set the Perches of the breadth of an Acre, and then in the two columnes following appeareth how many Perches, and how many foote that same Acre must have for his length.

Master. You take it well: howbeit to speake exactly of breadth and length, and the first columne doth sometime betoken the breadth, and sometime the length: for properly the longest side of any square doth limit his length, and the shorter side doth betoken the breadth, yet it is no great abuse in such Tables, where a man cannot well change the title, to let the name remaine, although the proportions of the numbers doe change: for still by the first columne is expressed the measure of the one side, and by the two other Pillars in one columne, is set forth the measure of the other side. And this shall bee sufficient now for the vse of the Golden Rule.

# The Rule of Fellowship.

NOw somewhat will I touch certaine other Rules which for their seuerall names may seeme diuers Rules, and distinct from this, but indeed they are but branches of it: yet because they haue seueral workings in appearance, but also

also pleasant in vse, I will giue you a taste of each of them. As for the Rule of Fellowship, both single and double, with time and without time, I shall need to say little more then I haue already said in teaching the workes of whole numbers: yet an example or two will wee haue to refresh the remembrance of the same, and to declare certaine proper vses and applications of it, as this for one. The Rule of Fellowship without time.

*Foure men got a booty or prize in time of warre, the prize is in value of money* 8190 *pound, and because the men be not of like degree, therefore their shares may not bee equall, but the chiefest person will haue of the booty the third part, and the tenth part ouer: the second will haue a quarter, and the tenth part ouer; the third will haue the sixth part: and so there is left for the fourth man a very small portion, but such is his lot (whether he be pleased or wroth) he must be content with one* 20 *part of the prey. Now I demand of you what shall euery man haue to his share?* A question of inequall society.

Scholar. You must bee faine to answer to your owne question, else it is not like to be answered at this time.

Master. The feate to vnderstand the solution of this question, and all such like, is this: Reduce all the Denominators into one number by Multiplication, except that any of them be parts of some other of them, for all such parts you may ouerpasse, and take for them all those numbers, whose parts they be: As in this example the shares be these $\frac{1}{10}$, $\frac{1}{4}\frac{1}{10}$, $\frac{1}{6}\frac{1}{10}$, if

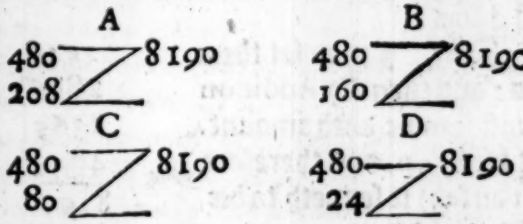
I multiply all the denominators together, beginning with 3, and so go on vnto 20, it will make 144000: but considering that 3 is a part of 6 I will omit that 3, and likewise 10, which is a part of 20, I may overpasse also, and then is there but 3 denominators to multiply, that is, 4 6 & 20 which make 480, which summe I take for my worke, because all the denominators will be found in it. Then I take such parts of it as the question importeth, that is, for the first man $\frac{1}{3}$ and $\frac{1}{10}$, the $\frac{1}{3}$ is 160, the $\frac{1}{10}$ is 48, which I put in one summe for the first mans share, and it maketh 208. Then for the second mans share, I take $\frac{1}{4}$. which is 120, and $\frac{1}{10}$ which is 48, and that maketh in the whole 168. Now for the third man which must haue $\frac{1}{6}$ I take 80. And for the fourth man there remaineth but 24, which is $\frac{1}{20}$ of the whole summe: so that if the whole prey had beene but 480 pound, then were the question answered: but because the summe was of greater value, by this meanes now shall I know the partition of it. I must set my numbers by the order of the Golden Rule, putting in the first place the number of that I found by multiplying the Denominators, and in the second place the summe of the booty, And looke what proportion is betweene the first number and the second, the same proportion shall be betweene the parts of that first number, and the parts of the second, comparing each to his like. Therefore I must put in the third

The reason of this rule.

third place, one of the parts or shares, and then worke by the former Rule of proportion or Golden Rule. And because I haue foure seuerall parts of the first number, by which I would finde out foure like parts of the second number, therefore must I make foure seuerall figures.

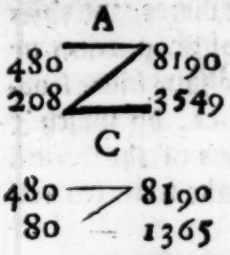
Scholar. Now I trust I can answer to your question, as by your fauour I will proue:

And to trie it, I set the foure figures thus, marked with A,B,C,D, to shew their order:




And then in each of them I multiply the second number by the third, and diuide their totall by the first, and so amounteth the fourth summe which I seeke for: For if I do multiply 8190 by 208, it maketh 1733520, which being diuided by 480, maketh in the quotient 3549 for the first mans portion.

And so working with the other three figures, I finde for the second man 2866 $\frac{1}{3}$, and for the third man 1365, and then for the fourth man 409 $\frac{1}{3}$, and so euery mans share is set forth in the figure here annexed.




The proof by Addition.

And thus I thinke I haue done well.

Maſter. If you miſdoubt your working, and liſt to proue it, adde all the ſhares together; and if they make the totall, then ſeemeth it well done.

Scholar. I may ſet them thus: and then by Addition the laſt ſumme doth amount, that is, 8190, and therefore (as you ſay) it ſéemeth to bée well wrought.

| | |
|---|---|
| | 3549 |
| | 2866 1/3 |
| | 1365 |
| | 409 1/3 |
| | 8190 |

But I beſéech you, is there any doubt in this triall, that you vſe that word, Séemeth?

Maſter. You may eaſily coniecture, that if you did aſſigne the firſt mans ſhare to the laſt, and ſo change all the reſt, and one had anothers ſhare, yet would the Addition appeare all one, and therefore is not the proofe exact.

But if you will make a iuſt proofe for the firſt mans part, take 1/3 and 1/10 of the whole ſumme, and if it agrée with the number in the figure, then it is well done. And ſo do for the ſecond, third, and fourth ſummes, and this proofe faileth not. Now will I propound certaine other queſtions, which haue béene ſet forth

The iuſt proofe.

forth by certaine learned men, albeit not without some ouersight, which questions I protest heartily, I doe not repeat to depraue those good men, whose labours and studies I much praise, and greatly delight in. But only according to my profession, to seeke out truth in all things, and to remoue all occasions of errour as much as in me lieth: and for that cause I will onely name the questions without hurting the Authors name.

The first question is this.

*Foure men did build an house, which cost them 3000 crownes, their shares were such that one man should pay $\frac{1}{2}$ of the summe, and sixe crownes ouer: the second should pay $\frac{1}{3}$ and 12 crownes ouer: the the third man must lay out $\frac{2}{7}$, abating 8 crownes: & the fourth man should pay $\frac{1}{4}$ and 20 crownes more. Can you answere to this question?*

A question of building.

Scholar. No, I cannot sir, and that you know best of any man, for I know no more then you haue taught me.

Master. Then I dare say you cannot do it, neither yet the best learned man that euer did propose it: for the question is impossible. For declaration whereof, I will be bold to vse first the representation of the nũbers in their aptest forme, (although I haue not yet taught that manner of worke) because it may appeare plainely that the question is not possible. For here I haue set the parts and added them, and they make the whole summe, and $\frac{1}{4}$ and 30 more. Now, how is it possible

An impossible question.

to

to diuide truely either gaines, either charges, so that the particulars $1\frac{1}{4}$ shall bee moze then the totall?

$\frac{1}{2} + 6$
$\frac{1}{3} + 12$
$\frac{2}{3} - 8$
$\frac{1}{4} + 20$
$1\frac{1}{4} + 30$

Scholar. It is against the forme of proofe by addition of parts.

Master. You say truth. And (because you shall perceiue it the better) I will trie it after the vulgar forme, as in this figure you see where the $\frac{1}{2}$ with 6 ouer, is 1506, for the totall as you heard before, is 3000, the $\frac{1}{3}$ and the 12 more is 1012: the $\frac{2}{3}$ would be 2000, but then abating 8, it is but 1992, and then last of all, the $\frac{1}{4}$ is 750, and the 20 more maketh 770: which all being added in one summe, doe make 5280, where the totall summe should bee but 3000, which sum of 3000 if you diuide by $1\frac{1}{3}$ or $\frac{4}{3}$, you shal haue $\frac{3}{4}$ of it, that is 2250, and thereto adde 30 more, then will those 3 summes make 5280: whereby you may see how this forme (as well as the other) doth declare that the particulars in that question would make more then the whole summe by $\frac{3}{4}$, and 30 more, and therefore can that question not be accepted as a possible thing, but yet doe certaine learned men propound such questions, and answere to them:

1506
1012
1992
770
5280

2000
2250
5280

There-

Therefore somewhat to say to their excuse (rather of their good meaning, then for their doing) I will anone declare what may bee said for their defence: but in the meane season, I will propound the question as it may bee wrought by good possibility.

*As if foure men build a house together, and it cost them 3000 crownes, and then for the partition they agree thus: that as often as the first man doth pay 6 crownes so often the second man shall pay 4, the third man 8, and the fourth man 3. Or else thus, that the first man shall pay double so much as the fourth, and the second man shall pay ⅔ of the first mans charge: the third man shall pay double so much as the second: and these two waies are to one end.) but further for their agreement it is appointed also, that the first shall giue 6 crownes ouerplus, and the second 12, and the fourth shall giue 20: but the third man shall giue no ouerplus, but shall haue 8 crownes abated of his charge.*

The former question of building now possible.

Now is the question possible to be assoiled, and this is the way to do it. Marke the proportion of the seuerall charges, and set out small nũbers in that rate, by which you may reduce the worke to the Golden Rule, as here in the first forme the numbers are already named, 6.4.8.3: and in the second forme (although they be but plainely named) yet they may be the same numbers: for 6 is double to 3, and 4 is ⅔ of 6: and againe 8 is double to 4. Now adde these together, and they make 21, which 21 must be set for the first number in the Gol-

den Rule: for if it with the ouerplus of each mans charge would make the totall summe of the charges, then were those seuerall summes the charges of each man, besides his ouerplus: but now it is not so.

The Rule, But yet this is true, (so excellent are conclusions Arithmeticall,) that loke what proportion each of their seuerall summes doth beare to 21, the same proportion doth the iust charges of euery man (besides his ouerplus) beare to the totall of the charges, the ouerplus being deducted: wherefore this may you note, that before you doe apply the totall of his charges to the Golden rule, you must deduct the ouerplus, which is 6, 12 and 20, that is in the whole 38: but then 8 must be restored for the abatement of the third man, and then remaineth to be deducted 30: take 30 therefore out of 3000, and there will rest 2970, which I must set in the Golden Rule for the second summe: & for the third summe I must put each of the small numbers before mentioned, which although they be not seuerall charges, yet they represent them in proportion. And so making for every mans charge a seuerall question, the figures will be 4, which I marke with foure letters, A, B, C, D, thus.

A

21 — 2970
6 — 848 4/7

B

21 — 2970
4 — 565 5/7

C

21 — 2970
8 — 1131 3/7

D

21 — 2970
3 — 424 2/7

Where I haue set for breuitie the sum of euery mans charge in the fourth place, presupposing that you can tell how to try out that fourth summe by so many examples as ye haue had.

Scholar. As I trust that I vnderstand this forme, so I desire much to know what may bee said for them that misstake this question.

Master. You seeme so desirous to know this errour, that haue forgotten to examine, whether this worke be without fault.

Scholar. It seemeth this worke to be well done, because the Addition of the foure seuerall numbers doth make the totall summe of 2970, which was to be diuided into such foure parts.

Master. But then haue you forgotten that the first man must pay sixe Crownes more besides his share, and the second man 12 Crownes more, the third man 8 Crownes lesse, and the fourth man 20 Crownes more: for without these, your first totall of 3000 Crownes will not be made.

Scholar: Then must I adde to the first mans summe 6 more, and it will bee $854\frac{4}{7}$, and to the seconds summe, I must adde 12, and it will be $577\frac{5}{7}$: from the thirds summe I must abate 8, and then will the summe be $1123\frac{3}{7}$: then adding vnto the fourths summe

20. it will be 444 $\frac{3}{7}$. and these foure summes will make 3000, which is the whole charge, as in this example it may appeare, where first I gather the $\frac{4}{7}$, that maketh 2, and so proceed I in the Addition to the end.

| | |
|---|---|
| | 854 $\frac{4}{7}$ |
| | 577 $\frac{5}{7}$ |
| | 1123 $\frac{1}{7}$ |
| | 444 $\frac{3}{7}$ |
| | 3000 |

Master. Now haue you well done, and this worke in the same summes is brought of other learned men for the true solution of the question, as it was first proponed, which (as I said) was impossible: and now examine by these seuerall sums, and see whether it doth agree with the sums in the question proponed.

The first man must pay $\frac{1}{2}$ and 6 ouer of the totall summe: how thinke you, is 854 $\frac{4}{7}$ the halfe, and 6 more of 3000?

Scholar. No that it is not, for it should be 1506: and for the second man 1012: and for the third man 1992, and for the fourth man 770: whereof not one summe agreeth to this worke. But I marueil, that so wise men could be so much ouer-seene.

Master. It is commonly seene, that when men will receiue things from elder Writers, and will not examine the thing, they seeme rather willing to erre with their Ancients for company, then to be bold to examine their workes or writings. Which scrupulosity hath ingendred infinite errors in all kindes of knowledge, and in all ciuill administration, and so in euery kinde of Art. But

these

these Learned men did not meane any o-ther thing by this question, then to finde such numbers as should beare the same proportion together, as those numbers in the question proponed did beare one to another: which thing you shall perceiue more plainly by another question of theirs, that is this.

*A man lying vpon his death-bed, bequeathed his goods (which were worth 3600 Crownes) in this sort. Because his wife was great with childe, and he yet vncertaine whether the childe were male or female, he made his bequest conditionally, that if the Wife bare a Daughter, then should the Wife haue halfe his goods, and the Daughter* $\frac{1}{3}$*, but if she were deliuered of a Sonne, then that Sonne should haue* $\frac{1}{2}$ *of the goods, and his Wife but* $\frac{1}{3}$*. Now it chanced her to bring forth both a Sonne and a Daughter; the question is: How shall they part the goods agreeable to the Testator his Will?* A question of a Testament.

Scholar. If some cunning Lawyers had this matter in scanning, they would determine this Testament to be quite voide, and so the Man to dye intestate, because the Testament was made insufficient, sith this condition was not expressed in it: and also it might haue chanced, that shee should haue brought forth neither Sonne nor Daughter, as often hath beene seene: so is the Will vnsufficient in that point also.

Master. Such Scanners should seeme to cunning, and yet not so cunning as cruell: for the minde of the Testator is to be taken favorably for the aide of the Lygatories, when there ariseth such doubt. But let vs try this worke, not by force of Law, but by proportion Geometricall, seeing the Testator did minde to provide for each sort of them.

Scholar. If the Sonne shall haue $\frac{1}{2}$ by force of the Testament, so must the mother haue $\frac{1}{3}$. Againe, because she hath a Daughter also, therefore ought she to haue $\frac{1}{3}$, and the daughter $\frac{1}{3}$, that is both wayes $\frac{1}{2}\frac{1}{3}$, and $\frac{1}{3}\frac{1}{2}$, which commeth to the whole goods, and $\frac{1}{3}$ more.

Wherefore it seemeth also impossible.

Master. In this matter, the minde of the Testator is so to be vnderstood, that such proportion should be betweene the portion of the wife and the sonne as is betweene $\frac{1}{3}$ and $\frac{1}{2}$, that is, the sonne must haue $\frac{1}{6}$ for $\frac{1}{6}$ to his Mother, so shall he haue 3 to 2, that is, as much as his Mother, and halfe as much more; and the mother must haue the like rate in comparison to her daughter. Then must I finde out three numbers in such proportion, that the first may haue as much as the second, and half as much more (that is) in proportion sesquialtera; and the second to the third, in that same proportion: such numbers be 9, 6, 4.

Scholar. I pray you Sir, how shall I finde out these numbers?

Master. That will I gladly tell you.

What-

To finde three numbers in any proportion.

Whatsoeuer the proportion bee of any three numbers, multiply the Termes of that proportion together; and the number that amounteth, shall bee the middle number of the 3: then multiply that middle number by the lesser terme, and diuide that totall by the greater, and the least number of the three will amount. So if you multiply that middle number by the greater extreame, and diuide the totall by the lesser extreame, then will the greatest number of that Progression amount.

To finde the proportion betweene two numbers.

Scholar. Then in this example to find the proportion of $\frac{1}{2}$ to $\frac{1}{3}$, I must diuide (as you taught me in diuision) $\frac{1}{2}$ by $\frac{1}{3}$, and the quotient will be $\frac{3}{2}$, that is, $1\frac{1}{2}$ whereby I perceiue that the proportion in this question, is as 3 to 2. Therefore as you taught mee euen now, I multiply 3 by 2, and the summe is, 6, which must be the middle number: then I multiply the middle number 6 by 2, which is the least terme, and the summe is 12, that I doe diuide by 3, being the greater terme, and the quotient is 4: so is 4 the least number of the three. Then I multiply 6 by 3, whereof commeth 18, and that I diuide by 2, and so haue I 9, which is the greatest number of the three.

Master. Another away yet may you finde the third number in any Progression, if you haue two of them: for if the middle number be one of them which you haue, then multi-

ply it by it selfe (as in this example, 6 by 6, maketh 36) and that totall diuide by the other number which you haue, and the third number will be the quotient.

Scholar. Then I diuide 36 (which commeth of 6 multiplied by it selfe) by 4, the quotient will be 9: and if I diuide 36 by 9, the quotient will be 4. But what if I know the first number and the third, and would haue the middle number?

Master. Multiply the two numbers together, and in their totall you must seeke the root of that number, and it shall be the middle number: but because as yet you haue not learned how to extract Rootes, therefore vse the first forme which I haue taught you, till I teach you to extract Roots. And now go forwards with the answer to the same question.

Note.

Scholar. I perceiue then, that the Sonne must not haue $\frac{1}{2}$ of the goods, neither the Mother $\frac{1}{3}$, nor yet the Daughter $\frac{1}{3}$, but yet must the goods bee diuided into such proportion, that the Sonne shall haue 9 Crownes for 6 to his mother, and the mother shall haue 6 Crownes for euery 4 to her daughter. Then I apply it to the Golden Rule in three examples, as followeth.

where the first number is the Addition of those three numbers 9, 6, 4: and the third is one of them seuerally: the second is the total of the goods in that Testament; and then by

by the worke of the Golden Rule, I finde out the fourth number in euery worke: that is for the Sonne $1705\frac{5}{19}$, for the mother $1136\frac{16}{19}$, and for the daughter $757\frac{17}{19}$: the which summes added together, doe make the summe of the whole goods as may bee seene by this Example.

19 Z 3600
9
19 Z 3600
6
19 Z 3600
4

$1705\frac{5}{19}$
$1136\frac{16}{19}$
$757\frac{17}{19}$
3600

And this (me thinketh) I doe perceiue, because in this case there is a necessary remedy deuised against an vrgent inconuenience: therefore those Learned men thought they might vse the like liberty in that other question.

Master. Your gesse is good, but they had so good reason for them in the one, as they haue in the other: As in another example of theirs, it may better appeare, as in this.

Another question of a Testament.

*A man left vnto his three Sonnes 7851 crownes to be parted in such sort, that the first Sonne should haue $\frac{1}{2}$, the second sonne $\frac{1}{3}$, and the third sonne $\frac{1}{4}$, which is not possible: for $\frac{1}{2}$, and $\frac{1}{3}$ and $\frac{1}{4}$ doe make $\frac{26}{24}$, or $\frac{13}{12}$, that is, $1\frac{1}{12}$, so is it more then the whole, but reduce these Fractions into one denomination, the least that they will come to, and they will*

be

*be* $\frac{6}{13}$, $\frac{4}{13}$, $\frac{3}{13}$, *and so may you part the goods into such proportion as these three numerators beare together, that is, the first to haue 6 for euery 4 to the second, and the second to haue 4 as often as the third hath 3: and so their portions will bee for the first,* 3623 $\frac{7}{13}$ *for the second* 2415 $\frac{9}{13}$, *and for the third* 1811 $\frac{10}{13}$; *and these three shares added together, will make the totall summe of the whole goods, as you may easily see in this example.*

| | |
|---|---|
| | 3623 $\frac{7}{13}$ |
| | 2415 $\frac{9}{13}$ |
| | 1811 $\frac{10}{13}$ |
| | 7851 |

Another question is there proponed thus.

Another like question.

*There are* 450 *crownes to be diuided betweene three men, so that the first man must haue* $\frac{1}{3}$ *and* $\frac{1}{3}$, *the second man* $\frac{1}{3}$ *and* $\frac{1}{4}$; *the third man shal haue* $\frac{1}{4}$ *and* $\frac{1}{5}$.

Scholar. I maruell that any man should be so ouer sene, to propone that question as a thing possible, sith $\frac{1}{3}$ $\frac{1}{3}$, $\frac{1}{3}$ $\frac{1}{4}$, $\frac{1}{4}$ $\frac{1}{5}$, doe make 1 $\frac{13}{15}$ that is almost double the whole summe.

☞ But I perceiue it might bee thus proponed: that as often as the first man did receiue 50 crownes, so often the second man should receiue 35, and the third man 27: for $\frac{1}{3}$ and $\frac{1}{3}$ is equall to $\frac{50}{60}$: and so is $\frac{1}{3}$ and $\frac{1}{4}$ equall to $\frac{35}{60}$, and $\frac{1}{4}$ and $\frac{1}{5}$ is $\frac{27}{60}$: and so working the question, the three figures will appeare in this forme: whereby the first mans portion is found to bee 200 $\frac{50}{56}$: the second mans part is

| | |
|---|---|
| 112 | 450 |
| 50 | 200 $\frac{50}{56}$ |
| 112 | 450 |
| 35 | 140 $\frac{35}{56}$ |
| 112 | 450 |
| 27 | 108 $\frac{17}{56}$ |

140 $\frac{35}{56}$

140 $\frac{31}{36}$: the third mans share 108 $\frac{27}{36}$: which in the whole doth make 450 Crownes to bee diuided betweene them.

Master. And thus you are (I thinke) sufficiently instructed in the Rule of Fellowship.

# The Rule of Alligation.

*NOw will I go in hand with the Rule of Alligation; which hath his name, for that by it there are diuers parcels of sundry prices, and sundrie quantities alligate, bound, or mixed together: whereby also it might be well called the Rule of Mixture; and it hath great vse in composition of Medicines, and also in mixtures of Metals, and some vse it hath in mixtures of Wines; but I wish it were lesse vsed therein than it is now adayes. The order of this rule is this.* The Rule of Mixture.

When any summes are proponed to bee mixed, set them in order one ouer another, & the common number (whereunto you will reduce them) set on the left hand; then marke what summes be lesser then that common number, and which be greater, and with a draught of your Penne euermore linke two numbers together, so that one be lesser then The reason of this Rule.

the

the common number, and the other greater then he: (for two greater or two ſmaller cannot well be linked together) and the reaſon is this, that one greater and one ſmaller, may be ſo mixed that they will make the meane or common number very well: but two leſſe can never make ſo many as the common number, being taken orderly: no more can two ſummes greater then the meane, ever make the meane in due order, as it ſhall appeare better to you hereafter. And, as it is of neceſſity to linke every ſmaller; (once at the leaſt) with one greater, and every greater with one ſmaller, ſo it is at liberty to linke them oftner then once: and ſo may there be to one queſtion, many ſolutions. When you haue ſo linked them, then marke how much each of the leſſer numbers is ſmaller then the meane or common number, and that difference ſet againſt the greater numbers which be linked with thoſe ſmaller, each with his match ſtill on the right hand, and likewiſe the exceſſe of the greater numbers aboue the meane, you ſhall ſet before the leſſer numbers, which be combined with them. Then ſhall you (by Addition) bring all theſe differences into one ſumme, which ſhall be the firſt number in the Golden rule, and the ſecond number ſhall bee the whole maſſe that you will haue of all thoſe particulars: the third ſumme ſhall be each difference by it ſelfe, and then by them ſhall be found the fourth number, declaring the juſt por-

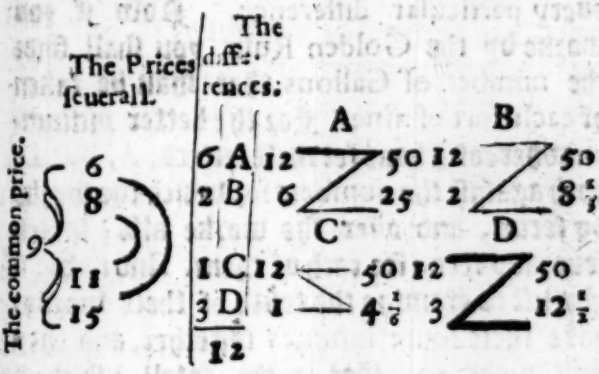
portion of euery particular in that mixture: As now by these examples I will make it plaine.

*There are foure sorts of Wine, of seuerall prices, one of* 6 pence *a gallon, another of* 8 pence, *the third of* 11 pence, *and the fourth of* 15 pence, *the gallon. Of all these wines would I haue a mixture made, to the summe of fiftie gallons, and so the price of each gallon may be* 9 pence. *Now demand I, how much must be taken of euery sort of Wine?*

Aqueſtion of mixing of wines.

Scholar. If it shall please you to worke the first example, that I may marke the applying of it to the rule: then I trust I shall bee able, not onely to doe the like, but also to see the reason in the order of the worke.

Master. Marke then this forme, and the placing of euery kinde of number in it.




Here (you see) I haue set downe the seuerall

rall prices which be 6, 8, 11, 5, and haue linked together 6 with 15, and 8 with 11. The common price 9, I haue set on the left side, and the difference betweene it, and euery particular price, I haue set on the right hand, not against the summe (whose difference it is) but against the summe that it is linked withall, so the difference of 15 aboue 9. is 6, which I haue set, not against 15 but 6, that is linked with 15, and the difference betweene 6 and 9 (that is 3) I haue set against 15. So likewise the difference betweene 8 & 9, is but 1, that I haue set against 11, and the difference of 11 aboue 9 (which is 2) I haue set against 8. Then adde I all those foure differences, and they make 12, which I set for the first number in the Golden Rule: the second number I make 50, which is the summe of Gallons that I should haue, and the third summe is euery particular difference. Now if you worke by the Golden Rule, you shall finde the number of Gallons that shall be taken of each sort of wine: For the better distinction whereof I haue set these letters, A, B, C, D, both against the numbers for which the workes do serue, and ouer the worke also; which seuerally serue for each of them. And now (if you list to examine the truth of these workes) adde these foure summes together, and they will make 50, that is the totall which I

The proof of this Rule.

would

would haue, as by this example you may easily perceiue. And (for to proue how the prices doe agrée) doe this: multiply the torall summe 50, by the common price 9, and it will make 450: then kéepe that summe by it selfe, and afterward multiply euery seuerall summe of gallons, by the price belonging to the same gallons, til that summe doe agrée with this which you haue kept first, then is your worke well done. As here 25 is the number of gallons of 6 pence price, multiply then 25 by 6, and it maketh 150, which you shall set downe, then multiply $8\frac{1}{3}$ by 8, which is the price for the number of gallons, and it will make $66\frac{4}{6}$: so againe $4\frac{1}{6}$ multiplied by 11: doth make $45\frac{1}{6}$. And last of all, $12\frac{1}{2}$ multiplied by 15, maketh $187\frac{1}{2}$: and these added together doe make 450, as in the example annexed you may sée, wherefore séeing it doth agrée with the former summe of 50, multiplied by 9, I may iustly affirme this worke to be good, and well done.

| | |
|---|---|
| 25 | |
| $8\frac{1}{3}$ | |
| $4\frac{1}{6}$ | |
| $12\frac{1}{2}$ | |
| 50 | |
| 150 | |
| $66\frac{4}{6}$ | |
| $45\frac{1}{6}$ | |
| $187\frac{1}{2}$ | |
| 450 | |

*And now to proue how you can doe the like I propound the same question, onely willing you to vse some other forme of combining or linking the summes.* The variation of this question.

Scholar. That shall I proue with your fauour, & therefore I combine 8 with 15 and 6 with 11, & then the forme will be as 5 followeth,

6




Whereby amounteth the same summe in totall of the differences as did before: and yet now the differences be altered as the combination is changed, whereof I understand the reason by your former worke. And therefore here appeareth no strange thing, but that now I haue 8 2/6 gallons of 6 pence, and 25 gallons of 8 pence, and 12 gallons and 3/6 of 11 pence, and so consequently 4 gallons and 1/6 of 15 pence: so that multiplying 8 2/6 by 6, it maketh 50, and then 25 multiplyed by 8. maketh 200. likewise 12 3/6 multiplied by 11 yeld 137 3/6, and 4 1/6 multiplied by 15, maketh 62 1/6, which 4 summes added into one, will yeld in the totall 450, which agreeth with the multiplication of 50, (being the total summe of gallons) by 9 the common or meane price.

| | |
|---|---|
| 50 | |
| 200 | |
| 137 1/2 | |
| 92 1/2. | |
| 450 | |

Master. Seeing you conceiue this worke so well, I will propound another example vnto you of more variety, in the Alligations or combinings, as thus:

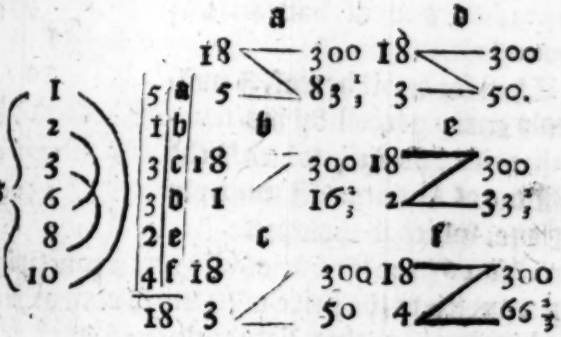
A

*A Merchant being minded to make a bargaine for Spices, in a mixt masse (that is to say,) of Cloues Nutmegs, Saffron, Pepper, Ginger, and Almonds: the Cloues being at 6 shillings, Saffron at 10 shillings, Pepper at 3 shillings, Ginger at 2 shillings, and Almonds at 1 shilling.* A question of Spices.

Now would he haue of each sort some, to the value of 300 pound in the whole, and each pound one with another: to beare in price 5 shillings: How much shall he haue of each sort?

Scholar. That will I try thus.

First, I set downe those fiue seuerall prices and at the left hand I set the common price, 5 shillings. Then I linke them thus, 1 with 10, 2 with 6, and 3 with 8: as in the example following.




Master. I had minded to haue combined them in more variety: but I am content to see your owne worke first, and then more varieties in combination may follow anon.

Scholar. Then to continue as I began, I take the difference betweene 1 and 5, (which is 4) and that I set against 10; then against 1 I set 5, which is the excesse of 10 aboue 5, so I gather the difference betweene 2 and 5, which is 3: and that I set against 6, because it is combined with 2: and likewise the difference of 6, aboue 5, (which is 1) I set against 2. Then take I the Difference of 3 from 5, which is 2, and that I set against 8: and before that 3, I set the difference of 8 aboue 5, which is 3. Then gather I all these differences by Addition, and they make 18, which I set for my first number in the Golden rule, and so appeareth by thos workes, that of Almonds I must take $83\frac{1}{3}$ pound, of Ginger $16\frac{2}{3}$ pound, Pepper 50 pounds, of Cloues, 50 pounds, of Nutmegs $33\frac{1}{3}$ pounds, and of Saffron $66\frac{2}{3}$ pounds.

| | |
|---|---|
| | $83\frac{1}{3}$ |
| | $33\frac{1}{3}$ |
| | 150 |
| Then for triall hereof, I multiply euery parcell by his seuerall price, as $83\frac{1}{3}$, which is the | 300 |
| | $266\frac{2}{3}$ |
| | $666\frac{2}{3}$ |
| summe of Almonds, I multiply by one, which is their price. | 1500 |

Also $16\frac{2}{3}$ the summe of Ginger, I multiply by 2, which is the price of it: and so each other in his kinde, as this Table annexed doth represent, and then adding them altogether, I finde the totall to be 1500, which also will amount by the multiplication of the grosse masse of 300, by the common price 5, where-

fore

fore it appeareth well wrought.

Master. Now I will make the alligation to prone your conning somewhat better: but because you shall not thinke your selfe pressed so much, I will also note the differences, as by this example you may see, where I




haue alligate 1 with 6 & 8, and therefore haue I set against 1 both their differences, that is 1 and 3: Likewise, because 2 is combined with 8 and 10, I set before him their differences, 3 & 5. Against 3 I haue set onely 5, which is the difference of 10, with whom 3 is combined onely. Likewise 6 is onely alligate to 1, & therefore is the differences of 1 from 5, which is 4 onely set against it: 8 is linked with 1 and 2, and therefore hath set 4 against him, both their differences, 4 and 3: and 10 is toyned with 2 and 3, therefore hath hee their differences, 3 and 2. And because of ease for you, in another columne I haue set the differences reduced into one number, for euery seuerall sort,

and haue also added them together, whereby appeareth that they make 33, and so consequently you sée the workes of the Golden Rule set forth. For the sixe drugges I haue added the letters, A,B,C, &c. as before.

But I would not wish you to cleaue still to these Elementary aides, but accustome Memory to trust her selfe: so shal occasion of negligence be best auoided, And as for the proofe, try it at more leisure, because the time now is short, and you sufficiently instructed in that proofe. And there resteth diuers things behind yet, of which I would gladly giue you some taste, before our departure.

Note.

Scholar. But if it may please you to let me sée all the variations of this question, before you goe from it, for me thinketh I could vary it two or three wayes more yet.

Master. I am content to sée you make two or three variations, but I would be loath to stay to sée all the variations, for it may be varied aboue 300 wayes, although many of them would not well serue to this purpose.

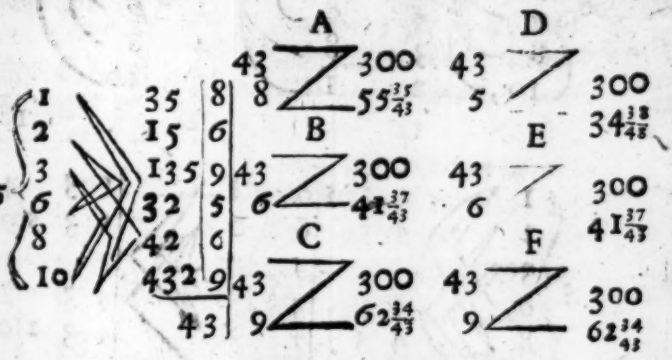
Scholar. I thought it impossible to make so many variations.

Note.

Master. Maruell not thereat, for some questions of this Rule may be varied aboue 1000 wayes: but I would haue you forget such fantasies, till a time of more leisure. And now goe forward with some variation of this question.

Scholar. For the first variation. I linke the

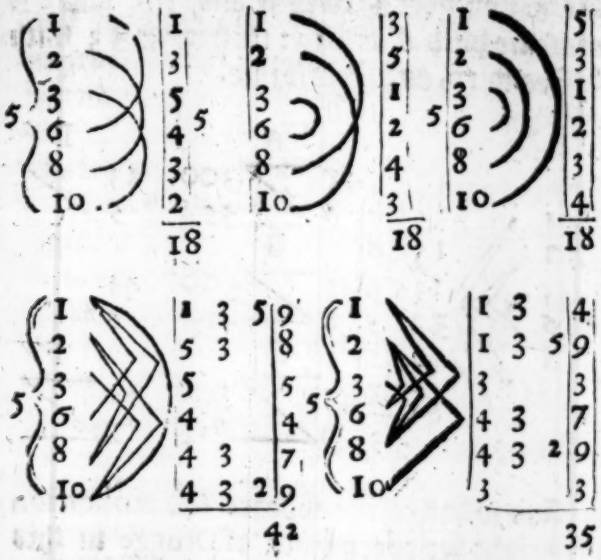
the first number 1 with 8 and 10, and 2 I combine with 6 and 10: then ioyne 3 with 6, 8, and 10, as in this forme.




And so doth there appeare the proportion of weight for euery kinde of Drugge in this mixture. Now for the tryall.

Master. Nay stay there: you shal not need to make triall in one example so often or if you list doe it by your selfe, I am content. But now set forth (for declaration that you conceiue the Rule) two or three examples of seuerall combinations, and then will we passe to some other example, and so end this Rule.

Scholar. As it pleaseth you, so will I doe. And these be the varieties: in which, as the



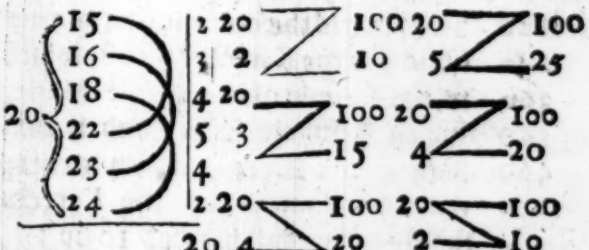

combinations are ſeuerall, ſo doth it plainely appeare, that the differences by which the proportion of each ſeuerall kinde is taken, are alſo ſeuerall. And yet I ſæ in the three firſt of theſe fiue varieties, and in one other before, the totall ſumme of the differences to be one, that is to ſay, 18. whereby I perceiue that the variety of their mixture doth depend on the variety of their differences ſeuerall, and not of the variety of their totall ſumme.

Maſter. So is it. And ſæing you conceiue it ſo well, I will make an end of this Rule, onely exhibiting vnto you one Queſtion or two of the mixture of Metals, that by it you may deuiſe others like, and exerciſe your ſelfe therein alſo, becauſe the vſe of it ſerueth often

in

in busines of charge, not so much for Goldsmiths, as of coynage in Mints. First I demand of you this question: *If a Mynt master haue Gold of* 22 *Karects, and some of* 23 *Karects, some of* 24: *Againe some* 15 *some* 16, *and some of* 18 *karects, and would mixe them, so that he might haue* 100 *ounces of* 20 *karects: How much must he take of each sort?* A question of mixing Gold.

Scholar. To know that, I answer in order, thus:




Master. You haue wrought the question well: but how chanced you made no doubt of that new name Karect?

Scholar. Because I thought it out of time to demaund such questions now, seeing you make so much haste to end: and againe in this case the proportion of the number, is sufficient for my purpose in this worke: trusting that another time you will instruct me as well of this, as of sundry other things, which as I haue heard you talke of, so I haue a great desire to them.

Master. Your answer is reasonable, and your request and trust (with Gods helpe)

I intend to satisfie. And now to goe forward with this matter, let me see your examination of this last worke.

Scholar. First for the one part I adde together all the particular summes, as they appeare in the worke, and they make 100, as here by their Addition doth appeare.

And soit seemeth that the summes are well gathered: but for the further tryall of them: I multiply first

| | |
|---|---|
| 10 | |
| 15 | |
| 20 | |
| 25 | |
| 20 | |
| 10 | |
| 100 | |

| | |
|---|---|
| 120 | 20 which is the common or meane |
| 240 | summe of the Karects by 100, which |
| 360 | is the summe of the whole Masse, |
| 550 | which I would haue, and it ma- |
| 460 | keth 2000. Then I multiply euery |
| 240 | particular summe by the Karects |
| 2000 | that it doth containe, as 10 by 15, |

and that maketh 150.

Likewise I multiply 15 by 16, and it yeldeth 240: so 20 by 18, maketh 360. And 25 by 22 yeldeth 550: likewise 20 by 23, bringeth forth 460; and last of all 10 multiplied by 24, yeldeth 240: which summes all ioyned together make 2000, that doth agree with the like summe before, wherefore I may well say, that the worke is good. And now if (it please you) I would set forth some varieties of this question to proue my wit.

Master. Goe to let me see.

Scholar. Here be foure varieties:

And







And more yet could I make, but not like to the number that you speake of in the variation of the other question.

Master. That will I teach you at more leisure, seeing it is a thing rather of pleasure then of any necessity.

*But now for your exercise in this Rule, one other question I will propose. A Mint-master hath six Ingots of silver of sundry fineness, some of foure ounces fine, and some of five ounces, some of six, and other of eight, some of* 11, *and other of* 12, *& his desire is to mixe* 500 *pounds weight, so that in the whole Masse every pound weight should beare nine ounces of fine silver: How much shall he take (say you) of every sort of silver?* A question of mixing of silver.

Scholar.

Scholar. To finde out that, I set the numbers thus in order.




And gathering the differences, it will appeare, that, of the first sort there must be $43\frac{11}{23}$ of the second like much: of the third sort $65\frac{5}{23}$: and of the fourth sort as much: of the fift sort $195\frac{15}{23}$ and of the sixt sort $86\frac{22}{23}$, which in the whole will make 500 pound weight, and in ounces after 9 ounces fine 4500, that is of the first sort $173\frac{21}{23}$: and of the second sort $217\frac{9}{23}$: of the third sort $391\frac{7}{23}$: of the fourth sort $521\frac{17}{23}$ of the fift sort $2152\frac{4}{23}$, and of the sixt sort $1045\frac{15}{23}$, which altogether doe make 4500 ounces, agreeable to the multiplication of 9 by 500.

Master. This is well done of you, therefore now make three or foure varieties, and so an end of this Rule.

Scholar. These 4 varieties I set for example.







Master.




Master. And by these it appeareth, that you can find out more, with which I will not now meddle, saue onely (for to shew you an easie helpe in drawing the lines of Combination) I will set forth two varieties here.




And this shall suffice now for the Rule of Alligation or mixture: for by these examples may you easily conjecture such other as do appertaine to it, as well for the due working, as for variety of drawing the lines of combination.

Scholar. Sir, albeit it pleased you erewhile to put me from my musing at the many varieties that may fall in these combinations and termed them fantasies; yet my fantasy

fantaſy giueth me, that the conſideration of this ſhould in many other examples and caſes of importance be very needfull, and the knowledge of it moſt profitable. Therefore ye may well thinke, that at another time conuenient I will requeſt you to aide me herein.

Maſter. Truth it is that this conſideration may fall in practiſe as well Politicke as Philoſophicall, and ſundry wayes in them be applied: Therefore when time ſhall fall fit for the diſcuſſing of this conſideration, you ſhall not want my helping hand.

# The Rule of Falſhood.

The occaſion of, the name.

*NOw will I briefly alſo teach you ſomewhat of the Rule of Falſehood, which beareth his name, not for that it teacheth any fraud or Falſhood, but for that by falſe numbers taken at al aduentures, it teacheth how to finde thoſe true numbers that you ſeeke for.*

Scholar. So might any other rule be called the Rule of Falſhood, for they worke by wrong numbers, and by them finde out the right numbers: ſo doth the Rule of Alligation, the Rule of Fellowſhip, and the Golden Rule partly.

Maſter.

Maſter. In the Golden Rule, the Rule of Fellowſhip, and the Rule of Alligation, although the numbers that you worke by, bee not the true numbers that you ſeeke for, yet are they numbers in iuſt proportion, and are found by orderly worke: whereas in this Rule the numbers are not taken in any proportion, nor found by orderly worke, but taken at all aduentures.

And therefore I ſometimes being merry with my friends, and talking of ſuch queſtions, to call vnto them ſuch children or Idiots as happened to be in the place, and to take their anſwere, declaring that I would make them ſolue thoſe queſtions, that ſeemed ſo doubtfull.

And indeed, I did anſwer to the queſtion, & worke the triall thereof alſo by thoſe anſwers which they happened at all aduentures to make: which numbers ſeeing they be taken as manifeſt falſe, therefore is this Rule called the Rule of falſe Poſitions, and for briefeneſſe, the Rule of Falſhood: which Rule for readineſſe of remembrance, I haue compriſed in theſe few verſes following, in forme of an obſcure Riddle.

*Geſſe at this worke as hap doth lead,*
*By chance to truth you may preceed,*
*And firſt worke by the queſtion,*
*Although no truth therein be don.*

*Such*

*Such falſhood is ſo good a ground,*
*That truth by it will ſoone be found.*
*From many bate too many mo,*
*From too few take too few alſo;*
*With too much ioyne too few againe:*
*To too few adde too many plaine.*
*In croſſe-wiſe multiply contrary kind,*
*All truth by falſhood for to find.*

The ſenſe of theſe verſes, and the ſumme of this Rule is this:

The expoſition of the Rule.

When any *queſtion is proponed* appertaining to this *rule*, firſt imagine any *number* that you liſt, which you ſhall name the *firſt poſition*, and put it in ſtead of the *true number*, and then worke with it as the *queſtion* importeth: and if you haue miſſed, then is the *laſt number* of that worke either too *great* or too *little*: that ſhall you note as hereafter ſhall be taught you and you ſhall call it the *firſt errour*.

Then beginne againe, and take another *number*, which ſhall be called the *ſecond poſition*, and worke by the *queſtion*: if you haue miſſed againe, note the exceſſe or default as it is, and call that the *ſecond errour*. Then multiply croſſe-wiſe the *firſt poſition* by the *ſecond errour*, and againe the *ſecond poſition* by *the firſt errour*, and note their *totals* ſeuerally by the names of *totals*. Then marke whether the two *errours* were *both alike*, that is to ſay, both *too much* or both *too little*: or whether they bee *vnlike*, that is, the one too *much*, and the other too little:

*little*: for, if they be like, then shall you *subtract* the one *totall* from the other (I meane the *lesser* from the *greater*) and the *remainer* shall be your *Diuidend*: so must you abate the *lesser errour* out of the *greater*, and the residue shall be the *Diuisor*. Now diuide the *Diuidend* by that *Diuisor*, and the *quotient* will shew you the *true number that you seeke for*. But, and if the *errours be vnlike*, then must you adde both those *totals* (which you noted) together, and take that *whole number* for the *Diuidend*, so shal you adde both *errours* together, and that *whole number* shal be the *Diuisor*, and the *Quotient* of that Diuision shall giue you the *true number* that the *question* seeketh for, and this is the whole rule.

Scholar. This rule seemeth so vnlike any other, that without some example I shall not easily vnderstand it.

Master. With a good will: propose halfe a score sundry questions & examples of variety, for the better vnderstanding of the worke hereof: and for the first take this example. *A Mason was bound to build a wall in* 40 *daies, and it was couenanted so with him, that euery day that hee wrought, he should haue for his wages* 2 shillings 1 penny, *and euery day that he wrought not, hee should be amerced* 2 shillings *sixe* pence, *so that when the wall was made, and the reckoning taken of the daies that he wrought, and of the other that hee wrought not, the Mason had cleerely but fiue* shillings *fiue* pence *for the worke*. *Now doe*

A question of Masonry. The first example.

Iohn Baker

*doe I demand how many daies did he worke of those 40, and how many did he not worke?*

Scholar. I pray you expresse the order of the worke, that I may partly by imitation, and partly by comparing it with the Rule, be able againe to doe the like.

Master. This order shall you keepe in the worke of this rule: first take some number (as you list) at aduenture, as for example, I say hée plaied 12 daies, and wrought 28 daies. Now cast you the wages of euery day, and sée whether it will agrée with the summe of 5 shillings 5 pence.

Scholar. The 28 daies that he wrought after 25 pence the day, yéeldeth 700 pence: Then 12 daies that hee wrought not, at 30 pence each day, doth amount to 360 pence, which if I abate out of 700 pence, there reseth 340: but you say he had not so much.

Master. Hée had but 65 pence, and by this supposition he should haue had 340: therefore is this summe too much by 275, which summe I must set downe after this sort as you sée héere, where first I haue made a crosse, (commonly called S. Andrewes crosse) and at the ouer corner, on the left hand I haue set the first position 12: and at the other corner vnder it I haue set 275, which is the first errour, with this figure + which betokeneth too much, as this line, — plaine without a crosse line betokeneth too little.

12

275+

On the right hand of the crosse I haue left two like roomes for the second position, and his error. Therefore to prosecute the worke, I suppose he played 16 dayes, and wrought 24.

Scholar. I was a while in doubt why you named the dayes of his working, seeing they be not set in the figure: and I doubted how you knew them, or else whether that you did suppose them at all aduentures, as you did the dayes that he played: but now I gather, that seeing 40 daies is the whole time limited, then the dayes that he played being supposed, the rest of 40 must néds be the dayes that he wrought, and therefore 28 followed 12 of necessity, and 24 followeth 16 also of necessity: but yet I scarse perceiue why you set not in the figures as well 28 as 12.

Master. It forceth not which of them I take, so that in the second position I take the numbers of the same nature that is here both of working daies, or both of idle, but now examine you this second position.

Scholar. If he played 16 dayes, then abating 16 times 30 pence, the summe will be 480 pence, and for 24 daies that he wrought, euery day yelding 25 pence, the totall is 600 pence: so that abating 480 out of 600, there resteth 120, and as you say, it should be but 65: therefore it is too much by 55: that must be set on the right hand of the figure at the neather part, and ouer it on the same side 16, which is the second position, thus:

And as I gather by your words, it were all one if I did set 28 in stead of 12, and 24 in stead of 16.




Master. So were it. But this shall you marke, that, of what nature soeuer the two positions be, of the same nature is the quotient. Therefore when the positions in this question are 12 & 16, which both being numbers of the playing dayes, the quotient shall declare the true number of playing dayes: whereas if the positions had bene 28 and 24, which are supposed to be the working daies, then would the Quotient declare the true number of the working dayes, and not of playing dayes, as it will do now. And therefore to continue the worke of this question, and to finde the true number of playing dayes, I must multiply crosse-wise the first position by 55, that is the second errour, and the totall will be 660. Then I multiply 275 and 16, and it yeeldeth 4400. Now because the errors are like, that is to say, both too much, I must subtract 660 out of 4400, and so remaineth 3740, which is the diuidend. Againe, I must subtract the lesser errour 55 out of 275, that is the greater errour, and there will remaine 220, which will be the diuisor: then diuiding 3740 by 220, the quotient will be 17. Wherefore I say now constantly, that 17 is the true number of dayes that the Mason plaied: and then it followeth that he wrought 23 daies, and so is the question answered.

Now

*Now for the order of triall of this worke, there needeth none other triall but onely this, to worke with this number according to the queſtion, and if it agree, then appeareth the number to be it that you would haue.*

The proof of this rule.

And here now ſeeing he wrought 23 daies, and muſt haue for euery day 25 pence, the whole ſumme cometh to 575. Then againe ſeeing he plaied 17 dayes, and muſt abate 30 pence for euery day, the whole ſumme of the abatement will be 510: Therefore I ſubtract 510 out of 575, and there will remaine 65, which maketh 5 ſhillings, 5 pence, the cleare wages of the Maſon for his worke, according to the queſtion.

Scholar. Now I truſt I vnderſtand the worke and the Rule ſo well (and the better by this proofe) that I can be able to do the like: And for a proofe, I take the ſame queſtion all ſaue the laſt number, where I will ſuppoſe that he had 10 ſhillings, for his wages cleare: And now to geſſe at the number of the dayes that hee wrought, I ſuppoſe firſt that hee wrought 20 daies: then ſay I, if he wrought 20 daies, his wages muſt be 500 d: then did he play other 20 daies, for which muſt be abated 600 d, and then he loſeth 100 d. And ſo am I at a ſtay, for it is not like to your former worke.

Maſter. You ſhould haue required of mee ſome queſtion, & not haue taken a queſtion of your own phantaſying, vntill you were more expert in this art: for ſo might you as well

happen to an impossible question, as on a possible: but now to goe forward, consider that this number is too little by 220, seeing hée should gaine by your supposition 120 pence, and in this position he loseth 100, those both make 220, which you shall set downe for the first error with this signe —, betokening too little, as here in this forme following doth appeare. 20



And now for the rest, go forward your selfe once againe. 220-

Scholar. As my errour hath vttered my folly, so it hath procured mée better vnderstanding.

Now therefore considering this position not to solue the question, I take another, supposing that he wrought 30 dayes: Then for his wages he must be allowed 750 pence, and for the 10 dayes which hée wrought not, hée must abate 300 pence, and so remaineth cleere 450 pence, but it should be onely 120 pence, therefore is it too much by 330, which I set downe in the figure with the former position and his errour; and the figure appeareth thus:

Now first I multiply in crosse wates 20 by 330, and it will be 6600. 20 30



Then againe I multiply 30 by 220, and it will be also 6600. Wherefore if I shall subtract the one 220- 330+

out

out of the other, there will remaine nothing to be the Diuidend.

Maſter. In this you forget your ſelfe againe: for in as much as the ſignes in the errours be vnlike, therefore muſt you worke by Addition, adding together thoſe two totals to make the Diuidend, and alſo adding the two errors to make the Diuiſor. And becauſe you ſhal no more forget this part of that Rule, take this briefe remembrance.

*Vnlike require Addition,*
*And like deſire Subtraction.*

Scholar. You meane, that if the errors haue like ſignes, then muſt the Diuidend and the Diuiſor be made by Subtraction, as is taught before: And if thoſe ſignes be vnlike (as in this laſt example they be) then muſt I by Addition gather the Diuidend and the Diuiſor. Therefore muſt I adde 6600 to 6600, and it will be 13200, which will be the Diuidend. Then againe I adde 220 to 330, and it will be 550, which muſt be the Diuiſor: wherefore diuiding 13100. by 550, the quotient will be 24, whereby I know that the Maſon wrought 24 daies, and then it followeth that he played 16 dayes.

Maſter. Examine your worke, whether it be agreeable to the queſtion or no.

Scholar. For 24 dayes worke the wages muſt be 600 pence, and for 16 dayes which the Maſon wrought not, there muſt be abated 480 pence, & then remaineth cleare to the

Maſon 120, as the queſtion importeth: wherefore it is euident that 24 is the true number of dayes that he wrought.

Maſter. Although you ſéeme now to vnderſtand this worke, yet to acquaint your minde the better with the new Trade of this Rule, I thinke it good to propone to you 5 or 6 examples more before I make an end of it.

Scholar. Sir, I thanke you that you doe ſo conſider my commodity and profit in knowledge, for vndoubtedly it is practiſe and exerciſe that maketh men prompt and expert in euery kinde of knowledge.

Maſter. You ſay well, ſo that they follow ſome certaine precepts to gouerne and rule their practiſe by, elſe may practiſe procure cuſtome of error, and a repugnance to exactneſſe of knowledge: namely, as long as the error is not plainely knowne to the vulgar ſort. But to returne to your worke.

A queſtion of wares, the ſecond example.

*There is a ſeruant that hath bought of veluet and damaske for his Maſter* 40 *yards, the veluet at* 20 ſhillings *a yard, and the damaske at* 12 ſhillings, *and when he commeth home, his Maſter demandeth of him how much hee hath bought of each ſort: I cannot tell (ſaith he) exactly: but this I know, that I paid for damaske* 48 ſhillings, *more then I paid for veluet: now muſt you geſſe how many yards there is of each ſort.*

Scholar. Although the geſſe ſéemeth difficult, yet I will proue what I can doe: for I remember your ſaying, that it forceth not

not how fond or falſe the geſſe be, ſo it be ſomewhat to the queſtion, and not an anſwer of a contrary matter.

Therefore firſt I imagine that he bought 20 yards of damaske, for which he ſhould pay after the former price 240 ſhillings: then muſt he néeds haue of veluet other 20 yards (to make vp the 40 yards) and that would coſt 400 ſhillings. So that the totall of the price of the Damaske is leſſe then the ſumme paid for Veluet 160 ſhillings, and ſhould be more by 48. Therefore the firſt errour is 208 too little: Then begin I againe, and ſuppoſe he bought of Damaske 30 yards, that coſt 360 ſhillings, then had he but 10 yards of Veluet, which coſt 200 ſhillings: and now the price of the Damaske is greater then the price of the Veluet by 160 ſhillings, and ſhould bee but 48, therefore is the ſecond errour 112 too much, which I ſet in forme of figure as here doth appeare. Then doe I multiply in croſſe wayes 208 by 30, and the ſumme will be 6240. Alſo I multiply 112 by 20, and there will amount 2240. And in as much as the ſignes of the errours be vnlike, I know I muſt worke by Addition, therefore adde I theſe two totals together, & they make 8480, which is the Diuidend: then adde I alſo the two errours together, 208 and 212, and they make 320, which is the Diuiſor: wherefore



diuiding 8480 by 320, the quotient will be $26\frac{1}{2}$, which is the true ſumme of yards of Damaske that he bought, and in veluet 13 yards $\frac{1}{2}$, and that appeareth by examination, thus: $26\frac{1}{2}$ yards of Damaske at 12 ſhillings the yard, maketh 318 ſhillings: then in Veluet he had but 13 yards, and $\frac{1}{2}$, and coſt 270 ſhillings, at 20 ſhillings the yard. Now ſubtract 270 out of 318, and there will remaine 48, which is the number of ſhillings that the Damaske did coſt more then the veluet.

Maſter. Now ſhall you haue a queſtion of another kinde.

A queſtion on of debt, the third example.

*There are three men that do owe money to me, and I haue forgotten what the totall ſumme is, and what the particulars be.*

Scholar. Why, then it is impoſſible to know the debt.

Maſter. Peace: you are too haſtie, there is more helpe in it then yet you ſee, I haue three ſeuerall notes, whereby it appeareth that I did conferre their debts together, and found the debt of the firſt and the ſecond to amount to 47 pound, the debt of the firſt man and the third man did make 71 pound, and the ſecond man his debt with the third did riſe to 88 pound. Now can you tell what euery man did owe, and what was the whole ſumme?

Scholar. Nay in good faith: but as I perceiue that it muſt be found by coniecture, ſo will I geſſe at it, ſuppoſing that the firſt man did owe 20 pound, and the ſecond man 30, and the third,

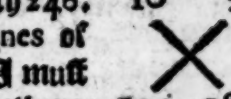
Maſter.

Maſter. Nay ſtay there, you are too farre gone already: you may not ſuppoſe a ſeuerall ſumme for euery man, for it is enough to ſuppoſe one ſumme for the firſt man, and let the other riſe as the queſtion importeth. Therefore ſeeing you ſet the firſt man his debt to be 20 pound, the ſecond man cannot owe 30 pound, for the declaration is, that their debts added together did make 47 pound, ſo muſt the ſecond man his debt be but 27 pound. Now the ſecond debt with the third, muſt make 88: therefore ſubtract 27 out of 88, and there will remaine 61, as the third man his debt. Then ſaith the declaration, that the firſt and third mans debts do make 71: but by this ſuppoſition they make 81, that is 10 too much, which I muſt ſet for the firſt errour. Now worke you the ſecond poſition.

Scholar. I ſuppoſe the firſt mans debt to be 24 pound: then muſt the ſecond mans debt (by your declaration) be but 23 pound, ſeeing both they make but 47 pound. And the ſecond man his debt with the third, doe make 88 pound, and the ſecond man oweth but 23: therefore the third man muſt owe 65 pound. Now the third mans debt with the firſt, ſhould make by the declaration 71 pound, and they doe make 89 pound, that is 18 pound too much, and that is the ſecond errour, which I ſet downe with the firſt, and their poſitions in this forme, and then I doe multiply in croſſe waies 20 by 18, & it is 360.

And

And 10 by 24 maketh 240. Also because the signes of the errours be like, I must worke by subtraction: therefore I subtract 240 out of 360, and there resteth 120, which is the diuidend: then do I subtract 10 out of 18 by the same reason, and so is the Diuisor 8, which is found 15 times in 120: therefore I say that the first man did owe 15 l. and then the second man must owe 32 l: for those 2 do make 47 l, and the third mans debt is 56: for so much remaineth if I abate 15 out of 71, or if I take 32 out of 88.




The fourth example.

Master. *For the fourth example, take this easie question for the variety in worke. Two men hauing seuerall summes, which I know not, do thus talke together: the first saith to the second, if you giue me* 2 shillings *of your money, then shall I haue three times so much money as you. The second man answereth; It were more reason that our summes were made equall, and so will it be if you giue me* 3 shillings *of your money. Now gesse what each of them had.*

Scholar. I imagine that the first had 9 s.

Note.

Master. Consider euermore in your imagination that you take a likely summe, as in this question, take such a summe, that hauing 2 added vnto it, may be diuided into 3 parts euen.

Scholar. Why? I remember you said before, it forceth not how fondly soeuer I guessed.

Master.

Master. As for the possibility of the solution, it is truth: but for easinesse in worke, the aptest numbers are most conuenient.

Scholar. I thought no lesse, and therefore I take 9 as an apt number to be parted into three: but I perceiue I should haue considered the aptnesse of that partition after the addition of two vnto it, and then 7 had béene more méet.

Master. That is truth, and then should the second man his summe be 5: for although hée haue now but the third part of 9, that is 3, yet you must remember that he lent the first man 2, and so had he 5.

Scholar. Then to goe forward: if the second man had three of the first man, then should hée haue 8, and the first man but 4: so hath he double to the first man: yet he said in the question they should haue equall: wherefore it appeareth that he hath 4 too much.

Therefore I note that error with his supposition, & gesse againe that he hath 10 shillings: whereunto I adde 2 shillings borrowed of the second man, & then he hath 12 shillings: so the second man hath remaining but foure, whereunto if I adde the 2 that hée lent to the first man, so had he but 6 shillings at the beginning.

Then take 3 s from the first man, and giue to the second, then hath the first man but 7, and the second hath 9, which are not equall, but there are 2 too

7 10

4½ 2½

many,

many, wherefore I set downe both the positions with their errors as before you see, & multiply a crosse, so commeth there 40 and 14: and because the signes be like, I take 14 out of 40, and so resteth 26 to be diuided: then likewise I take 2 out of 4, and there resteth 2, by which I diuide 26, and the quotient will be 13, which is the summe that the first man had. And so appeareth that 2 being added thereto, the summe will be 15, so hath the second man but 5, and before he had 7: then take 3 from the first, and put to his 7, and so haue each of them 10, and that is equall as the question would.

The fifth example: A question of Lambes.

Master. *For the fifth example, take this question. One man said to another, I thinke you had this yeare two thousand Lambes: So had I, said the other; but what with paying the tithe of them, and then three seuerall losses, they are much abated: for at one time I lost halfe as many as I haue now left, and at another time the third part of so many, and the third time $\frac{1}{4}$ so many. Now gesse you how many are left.*

Scholar. Because here is mention made of certaine parts, I must take a number that may haue all these parts, that is to say, $\frac{1}{2}$ $\frac{1}{3}$ and $\frac{1}{4}$ which will be 24, howbeit 12 hath the same parts. Therefore I take first 12 to bee the number that doth remaine, so hath he lost 6, 4, and 3, that is 13, and the whole 23, but it should be 2000.

Master. Ye are deceiued yet still, you haue to-

forgotten the 10 part, which must be defalked, that is 200, so there remaineth but 1800, and now go on againe.

Scholar. Then to finde the errour, I take 25 out of 1800, and there remaineth 1775 too few, which I set for the errour. Then for the second position I take 24, whose halfe is 12, the third part 8, and the quarter 6, whereby riseth 50, which is too little by 1750, therfore I set downe both the positions with their errours thus:

And multiply in crosse wises 1775 by 24, whereof cometh 42600. Also I multiply 1750 by 12, and there ariseth 21000. And because the signes are like, I do subtract the one from the other, and so remaineth the Diuidend 216000. Then do I subtract 1750 out of 1775, and there resteth 25, by which I diuide 21600, and the quotient is 864, whereof the halfe is 432, and the third part is 288 the quarter is 216, which all being added together, will make 1800. And if you adde thereto the tenth which was abated before, then will the whole summe be 2000.

| 12 | 24 |
|---|---|
| 1775- | 1750- |

| | |
|---|---|
| | 864 |
| | 432 |
| | 288 |
| | 216 |
| | 1800 |

And now doth there come a question to my memory which was demanded of me, but I was not able to answer to it: and now me thinketh I could solue it.

Master. Propone your question.

Scholar.

A queſtion of ſheepe & tillage, the ſixth example.

Scholar. *There is ſuppoſed a Law made, that (for furthering of tillage) every man that doth keep ſheepe, ſhall for every ten ſheepe eare and ſow one Acre of ground: and for his allowance in ſheepe paſture, there is appointed for every foure ſheepe one Acre of paſture. Now is there a rich ſheepe-Maſter which hath 7000 Acres of ground, and would gladly keepe as many ſheepe as he might: by that Statute I demand how many ſheepe ſhall he keepe?*

Maſter. Anſwer to the queſtion your ſelfe.

Scholar. Firſt I ſuppoſe hée may kéepe 500 ſheepe, and for them hée ſhall haue in paſture after the rate of foure ſheepe to an Acre, 125 Acres, and in Arable ground 50 Acres, that is, 175 in all: but this errour is too little by 6825. Therefore I gueſſe againe that he may kéepe 1000 ſheepe, that is in paſture 250 Acres, and in tillage, 100 Acres, which make 350, that is too little by 6650. Both theſe errours with their poſitions I ſet downe as you ſée, and multiply them croſſe 6825 by 1000, and it maketh 6825000, alſo I multiply 6650 by 500, and there commeth 3325000, which ſumme I ſubtract out of the former, and there remaineth 3500000 for the dividend; likewiſe I ſubtract the leſſer errour out of the greater, and there reſteth 175, by which I divide 3500000 (the Dividend aforeſaid) and the

500 1000
6825- 6650.

the quotient will be 20000, ſo that by this rate, he that hath 7000 Acres of ground may keepe 20000 ſheepe.

Maſter. You haue done well, notwithſtanding both this laſt queſtion, and the next before might be wrought without the ſecond poſition by the Rule of proportion, as this: When in this queſtion ye found in the firſt error that for 500 ſheepe, there muſt be 157 Acres, then might you reduce it to the Golden Rule thus: Another way of working.

175 Z 500
7000 Z 2000

*If* 175 *Acres will admit in allowance* 500 *ſheepe, then* 7000 *will haue* 2000. *And ſo by one poſition, with the helpe of the Golden Rule may you anſwer that queſtion.*

Likewiſe for the queſtion of Lambes, when you had found that 12 came of 25, you might haue ſet the figure as followeth, and haue ſaid:

25 Z 12
1800 Z 864

If 25 doe leaue but 12 what ſhall 1800 leaue? and it would appeare to be 864.

Scholar. Sir, I thanke you for this aide, for it doth much ſhorten the worke of this Rule.

Maſter. Yet againe, I will ſhew you an other way to anſwer to this laſt queſtion without the Rule of falſe poſition, and that by the Rule of Fellowſhip, for it appeareth in the propoſing of the queſtion, that 10 ſheepe Another way yet.

muſt

must haue in pasture two Acres and $\frac{1}{2}$, and for them must there be eared but one Acre: so it followeth, that for 2 Acres eared, there must be 5 set to pasture: and if you put them both into one summe, they will make 7. Therefore loke what proportion 7 being this totall, doth beare to 5 and to 2 such proportion shall any totall in this question beare to the pasture ground, and the eared ground.

Scholar. This serueth wonderous aptly. Therefore to proue it, I demand this by the former supposition: If a man haue 300 Acres, how much shall he leaue in pasture, and how much shall he turne to tillage? You say that as 7 is to 5, so shall 300 be to the Acres of pasture: and as 7 is to 2, so is 300 to the Acres of tillage, whereof for both I haue set examples here following, whereby appeareth that of Pasture, there shall be 214 $\frac{2}{7}$ Acres, and of Tillage 85 $\frac{5}{7}$, which both summes added together, doe make 300.

7 ⟌ 5 300 ⟌ 214 $\frac{2}{7}$

7 ⟌ 2 300 ⟌ 85 $\frac{5}{7}$

Another question, the 7. example.

Master. *Now take another example: A man hath three siluer cups with one couer, the couer wayeth 18 ounces, the second Cup wayeth euen halfe the weight of the first and the third. Now if the couer be put to the first Cup, they weigh iust as much as all the three Cups do weigh: and if the couer be ioyned with the second Cup, they weigh as much as the second twice, and the third: and if the*

Couer

*Couer be put to the Cup, they will make twice as much as the firſt and the ſecond Cup. Now try you what was the iuſt weight of euery Cup.*

Scholar. I do ſet the weight of the firſt Cuppe to be 9 ounces, then in as much as theſe two (that is to ſay, the couer and the firſt Cuppe) do wey the weight of the three Cuppes, I ſee that the three Cuppes muſt wey 27 ounces, for ſo much is 18 and 9. Alſo becauſe the firſt and the third do wey double ſo much as the ſecond: therefore it is the third part of that weight, that is 9, and then would it follow, that the third Cuppe alſo ſhould wey 9 ounces, but then the queſtion ſaith, that the Couer being ioyned to the ſecond Cuppe, they wey as much as the ſecond twice, and the third once, that ſhould be 27, and ſo it doth: that being ioyned with the third Cup, they ſhould wey twice as much as the firſt and the ſecond, that ſhould be 36, and they wey but 27, ſo is that errour 9 too little. Then begin I againe, and ſay, that the firſt Cup doth weigh 12 ounces, which I ioyne with the Couer, and they make thirty ounces: then ſeeing the ſecond is of that weight, it muſt needs weigh 10 ounces, and the third muſt wey 8 ounces, ſeeing the firſt and the third muſt wey 20 ounces. Now put I the Couer to the ſecond Cuppe, and they wey 28 ounces, which ſhould be euen 3 3, then ioyne I the couer with the third Cup, ſo ſhould it wey twice the firſt & the ſecond,

that is 44 ounces, and they wey but 26, that is 18 too little: those errors with their positions I set down, and multiply in croſſe wayes 9 by 12, whereof commeth 108: Alſo 9 by 18, that yeeldeth 162: and in as much as the ſignes be like, I abate the leſſer out of the greater, and there doth remaine 54. Then doe I alſo abate the leſſer errour from the greater, and ſo remaineth 9, by which I diuide 54, and the quotient is 6: which I take for the true weight of the firſt Cup, which being ioyned with the Couer, muſt wey as much as the three Cups, ſo do they wey but 24 ounces. Then ſeeing the ſecond Cup is the third part of that weight, for the other two Cups (you ſay) muſt wey double his weight, the weight of the ſecond Cup is 8 ounces, and ſo the weight of the third muſt be 10 ounces. Now put the Couer to the ſecond Cup, and it will make 26 ounces: that muſt be the weight of the ſecond twice, and the third once, that is, twice 8, and once 10, and ſo is it. Againe, put the couer to the third Cup of 10 ounces, and they muſt wey twice as much as the firſt and the ſecond, that is, 28, and ſo is all agreeable.

9 12
X
9 18

A queſtion of water: the eight example.

Maſter. Then anſwer to this queſtion.

*There is a Ceſterne with foure Cockes, containing 72 barrels of water: and if the greateſt Cocke be opened, the water will auoid cleane in ſix houres, at the ſecond Cocke it will aske eight houres: at the*

third

*third Cocke it will auoide in no leſſe then nine houres: and at the ſmalleſt it will require twelue houres. Now I demand in what ſpace will it auoid, all the Cockes being ſet open?*

Scholar. Firſt, I imagine it will auoid in two houres.

Maſter. Then muſt there auoid by the firſt Cocke $\frac{1}{2}$ of the water, that is 24 barrels, and by the ſecond Cocke $\frac{1}{3}$, that is 18, and by the third Cocke $\frac{1}{5}$, that is 16 Barrels, and by the ſmalleſt Cocke $\frac{1}{9}$, that is 12 Barrels, all which ſummes put together, doe make 70, as by their Addition it doth appeare, but it ſhould be 72: therefore the errour is 2 too leſſe.

Scholar. Then will I beginne againe by your fauour, becauſe I thinke I vnderſtand the worke, and put three houres for the due time: ſo ſhall there runne out at the greateſt Cocke $\frac{1}{2}$, that is, 36 Barrels, and at the ſecond hole $\frac{1}{3}$, that is 27, and at the third Cocke $\frac{1}{5}$, that is 24, and at the ſmalleſt hole $\frac{1}{9}$, that is 18 Barrels, which altogether doe make 105, and ſhould be but 72, ſo is it too much by 33; therefore doe firſt the errors in order of the figure with their poſitions, and worke by Multiplication, Croſſe, ſaying, two times 3 is 6, and two times 33 maketh 66, and becauſe the ſignes are vnlike,

| | |
|---|---|
| 24 | |
| 18 | |
| 16 | |
| 12 | |
| 70 | |

2 33

3 22

I muſt adde thoſe two totals together, which make 72: alſo I adde the two errors, and they make 35, by which I diuide 72, and the Quotient riſeth $2\frac{2}{35}$, whereby I ſee that all the Cockes being ſet open, the water will auoid in two houres, and $\frac{2}{35}$ of an houre.

Maſter. This exerciſe maketh you to grow expert in the Rule. Therefore I will inure you ſomewhat more with a queſtion or two.

A queſtion of partners. The ninth example.

*There were two men that had been partners, & had in account betweene them* 300 *Duckets, whereof the one ſhould haue for his part* 180, *and the other* 120: *but in the parting of the, they fell at variance; ſo that each of them catched as many as he could: yet afterward being reconciled, they agreed that he which had gotten moſt part of them, ſhould lay downe* $\frac{3}{4}$ *of them againe, & he that had gotten leaſt, ſhould lay downe* $\frac{1}{3}$ *of thoſe which hee had taken, and then parting them into two equall parts, each man to haue halfe thereof, and ſo had they their iuſt portions, as they ought: now I demand of you what each of them had gotten by the ſcambling?*

Scholar. I ſuppoſe he that had leaſt, got 108 duckets, then the other had 192: wherefore in laying downe againe of the 192, there was put downe $\frac{3}{4}$, that is 144, and ſo had he left but 48. Alſo of the 108, there was laid downe $\frac{1}{3}$ 36, that is $\frac{1}{3}$, and ſo hee had left 72. Then I put together 144 and 36, and it maketh 180, which I part into two parts euen, and ſo commeth 90 to bee giuen to each of them:

them: which ſumme put to 72, maketh 162, and ioyned to 148, it maketh 238: and now I doubt how I ſhall go forward.

Maſter. You need not to take but one of them, which you liſt, the greater or the ſmaller, for all cometh to one purpoſe: and ſo may you compare it that you take to any of the other ſummes, remembring that you make compariſon to the ſame in the ſecond worke: as for example of the firſt part. If you compare 138 with the leſſer ſum due, that is, 120, ſo is it 18 too much; and if you compare it with the greater ſumme, then is it 42 too little. Againe, if you compare [illegible] the greater ſumme, the error will be 18, as it was in the other: but it will haue a contrary ſigne: and if you compare it with the leſſer ſumme, it will be 42 too much: ſo that the error both waies is either 18, or 42: and as for the ſignes it little forceth, for in them is nothing conſidered here, but likeneſſe & vnlikeneſſe, which in this caſe doth neither further or hinder: But now go on with the worke. Note.

Scholar. If it be ſo, then am I out of my greateſt doubt. Then I ioyne that 90 (which I found as the halfe of the latter partition) vnto 48, which is left with the one man, and ſo hath he 138, which (I may ſay) is 18 too many, for the leaſt ſhould be but 120, that error do I note, and then make a new poſition, ſuppoſing the one man to haue 204, and the other to haue 96: wherefore of the 204, there

must be laid downe 153, and so remaineth with him 51. Also of the 96, there must be laid downe $\frac{1}{3}$, that is 32, and so resteth with that man 64: Now of the 153 and 32. I make one summe, as 185, which I must diuide into two equall pars, and so each man shall haue $92\frac{1}{2}$, whereunto if I adde their former portions reserued, then the one shall haue $156\frac{1}{2}$, and the other hath $143\frac{1}{2}$. Wherefore take the lesser summe now againe, as I did before, that is $143\frac{1}{3}$, and finde that he hath to many by $23\frac{1}{3}$, for he should haue but 120, so haue I for my two posi[illegible] two errors, which I set down as here may [illegible]ne, each error vnder his position, & then by the Rule I doe multiply in crosse-wayes 108 by $23\frac{1}{3}$, and there ri-seth 2538, which I note, then againe I multiply 96 by 18, and thereof amounteth 1728.

| 108 | 96 |
|---|---|
| 18 + | $23\frac{1}{3}$ + |

Now because the signes are both like, that is, both too many, I must worke by Subtraction, and so abating 1728 out of 2538, there will rest for the Diuidend 810: then for the Diuisor I subtract 18 out of $23\frac{1}{3}$, and there remaineth $5\frac{1}{3}$, by which I diuide 810, and the quotient will be $147\frac{3}{17}$, which is the iust portion of him that had the least summe. And if I doe subtract it out of 300, being the totall summe, then will there remaine $152\frac{3}{17}$, as the portion that the other did get.

Master.

Maſter. For the proofe of this worke, you may chuſe whether you will examine thoſe numbers according to the forme of the queſtions, or elſe worke by other two poſitions for to finde the ſecond number: and if thoſe poſitions bring the ſame numbers that did amount by the firſt two poſitions, then doth each worke confirme other. Note.

Scholar. By your patience, I will proue both waies, not onely to ſeeke their agreement, but alſo to accuſtome my minde to thoſe workes, for I perceiue it is exerciſe that muſt be the chiefe engrauer of theſe Rules in my memory.

Maſter. You conſider it well: then go to.

Scholar. Firſt I will by two other poſitions try to finde the portion of him which had moſt.

Maſter. Although you may doe it with any poſitions, yet to ſee the agreement of your worke the better, take the ſame poſitions that you did before comparing them now to the greater, as you did before vnto the leſſer.

Scholar. Then I ſuppoſe that he that had moſt, had 192, ſo had the other 108. Now if I take $\frac{1}{4}$ out of 192, that will be 144, and there will reſt to that man but 48. And from the ſecond which had 108, if I take $\frac{1}{7}$, that is 36, there will remaine to him 72: then ioyning 144 with 36, it will make 180, the halfe whereof being 90, If I adde to each of thoſe

two mens portions remaining with them, the one shall haue 138, and the other 162. of which two I take the greater, (that is 162) and see it to be 18 too few, for it should be 180, that errour I note vnder this position. Then for the second position I take (as I did before) 204 for the one, and so resteth 96 for the other: then take I $\frac{1}{4}$ of 204, and it will be 153, and there resteth to him 51. Also of the 96 I take $\frac{1}{3}$ that is 32, and there remaineth to him 64: now put I that 32 to 153, and it yeeldeth 185: which being parted in equall values, maketh $92\frac{1}{2}$ to be added to each mans remaine[illegible] so the one hath $143\frac{1}{2}$, and the other $150\frac{1}{2}$. Wherefore I take the greatest summe, and it is $23\frac{1}{2}$ too little, that doe I note also and set both these errors vnder their positions, as in this example following doth appeare.

And then multiplying 192 by $23\frac{1}{2}$, there doth arise 4512.

Againe, I multiply 204 by 18, and it maketh 3672, which I do subtract out of 4512, because the signes be like, and there resteth 840 for the diuidend, then subtracting 18 out of $23\frac{1}{2}$ there will remaine $5\frac{1}{2}$, which I must take for the Diuisor. And so dividing 840 by $5\frac{1}{2}$ the quotient will be $152\frac{8}{11}$, wherby I haue found an agreeable summe to that which I found by the former positions, for him that had most

192 204
18− $23\frac{1}{2}$−

moſt, which I doe ſubtract out of 300, that is the totall, there will reſt $147\frac{3}{11}$, which was the portion of him that had the leaſt part.

Maſter. So by diuers poſitions, you ſee, that one doth confirme the worke of the other. Now examine thoſe two numbers by the forme of the queſtion, & ſo ſhall you proue your worke good alſo.

Scholar. If that he which gate moſt, had $152\frac{8}{11}$, then muſt hee lay downe $\frac{1}{4}$ of this ſumme. That is $114\frac{6}{11}$, and ſo ſhall remaine with him but onely $38\frac{2}{11}$. The other which had leaſt, that is $147\frac{3}{11}$, muſt put downe of his ſumme $\frac{1}{3}$, that is $49\frac{1}{11}$, and ſo doth there remaine with him yet $98\frac{2}{11}$. Then doe I adde together $114\frac{6}{11}$, and $49\frac{1}{11}$, and it will make $163\frac{7}{11}$, which I muſt part into two equall parts, and that will be $81\frac{7}{11}$ to be giuen to each of them: putting $81\frac{7}{11}$ vnto $38\frac{2}{11}$, there doth amount 120 iuſt, which is the true portion of him that ſhould haue the leſſer ſumme: and adding $81\frac{7}{11}$ $98\frac{2}{11}$, the totall will bee 180, the true portion of the other. And ſo is the worke by this proofe alſo tryed to be good. And this I marke by the way, that in their ſcambling, he got moſt (as it chanceth often) that ought to haue had leaſt by iuſt partition.

Maſter. Let your ſtudy bee to learne truth and iuſt art of proportion, & to diſtribute and part according thereunto, as often as occaſion ſhall be miniſtred. And here would I make an end of this rule, ſaue that I remember

one

one pleasant question which I cannot ouer-passe, which I will declare somewhat largely, because you shall as well vnderstand some reason in the pleasant invention, as apt proceeding in the witty working thereof.

The tenth example of mixture of gold and siluer.

*Hiero king of the Syracusans in Sicilia, had caused to be made a Crowne of gold of a wonderfull weight, to be offered for his good successe in wars: in making whereof, the Goldsmith fraudulently tooke out a certaine portion of gold, and put in siluer for it, so that there was nothing abated of the full weight, although there was much of the value diminished.*

Which thing at length being vttered, (as no euill can alwaies lie hid) the King was sore mooued: and being desirous to trie the truth without breaking of the crowne, proponed the doubt to Archimedes, vnto whose wit nothing seemed vnpossible, which although presently he could not answer vnto, yet he had good hope to deuise some policy for that invention, and so musing thereon, as he chanced to enter into a baine full of water to wash him, he obserued, that as his body entred into the baine the water did runne ouer the Tub, whereby his ready wit of such small effects conjecturing greater works, conceiued by and by a reason of solution to the Kings question, and therefore reioycing exceedingly, more then if he had gotten the Crowne it selfe, forgat that hee was naked, and so ranne home, crying as he ranne, εὕρηκα, εὕρηκα, I haue found, I haue found. And thereupon caused two massy peeces,

pieces, one of gold, and another of ſiluer, to be prepared of the ſame weight that the ſaid Crowne was of: and conſidering that gold is heauier of nature then ſiluer, and therefore gold of like weight with ſiluer, muſt needs octupy leſſe rome by reaſon it is more compact and ſound in ſubſtance, he was aſſured that putting the maſſe of gold into a veſſel brimme full of water, there would not ſo much water run out, as when he ſhould put in the ſiluer maſſe of the like weight. Wherefore he tried both, and noted not onely the quantities of the water at each time, but alſo the difference or exceſſe of the one aboue the other, whereby he learned what proportion in quantity is betweene Gold and Siluer of equall weight. And then putting the crowne it ſelfe into the veſſell of water brim full (as before) marked how much water did runne out then, and comparing it with the water that ranne out when the Gold was put in, noted how much it did exceed that: and likewiſe comparing it to the water that ranne out of the ſiluer, marking how much it was leſſe then that, and by thoſe proportions found out the iuſt quantity of gold that was taken out of the Crowne, and how much ſiluer was put in ſtead of it: But ſeing Vitruuius which writeth this Hiſtory doth not declare the particular worke of this triall, it ſhall be no inconuenience to ſuppoſe an example for declarations ſake, wherein although the true and iuſt

pro-

proportion be not expressed, yet the forme of triall shall be truly set forth. And for an example, I suppose the weight of the crowne to be 8 pound, and so of each the other two Masses. And when the Masse of Gold was put into the water, I imagine that there ran out two pound of water: and when the masse of siluer was put in, I suppose there ranne out three pound $\frac{1}{3}$. Againe, when the Crowne was put in, there ranne out two pound $\frac{1}{4}$: Now to know what quantity of siluer was in the Crowne, worke by the Rule of false position, and imagine that there was two pound of siluer, then must there be six pound of gold, then say thus by the Rule of Proportion: If eight pound of gold do expell two pound of water, what shall sixe pound expell? and it will be 1 pound $\frac{1}{2}$. Againe for the siluer: if eight pound of siluer expell three pound $\frac{1}{3}$ of water, what shall 2 pound of siluer put out? it will be $\frac{7}{8}$, now adde those two weights of water together, and they will make two pound $\frac{3}{7}$, and it should be by the supposition two pound $\frac{3}{4}$ so is it too much by $\frac{1}{8}$.

Scholar. Now do I vnderstand the worke as I thinke, therefore I pray you let me worke the rest of the question. And because this first supposition did erre, I note that position and his errour, and take a new position, esteeming the siluer to be but one pound, so must there be in gold seuen pound. Then say I: if eight pound of gold do yeeld two

pound

pound of water, what shall seuen pound yelde? and it will be 1 pound $\frac{3}{4}$. Againe, if 8 pound of siluer expell 3 pound $\frac{1}{2}$ of water, what shall 1 pound expell? and it will be $\frac{1}{16}$. Now must I adde those two summes together, and they make 2 pound $\frac{1}{16}$, and they should make 2 pound $\frac{1}{4}$, so is it to little, by $\frac{1}{16}$. Therefore I set the positions, with their errors, in order as here followeth: And then I multiply in crosse wayes 2 by $\frac{1}{16}$, and it maketh $\frac{1}{8}$: Likewise 1 multiplied by $\frac{1}{2}$, maketh $\frac{1}{2}$. And because the signes be vnlike, I must adde these two summes, which make $\frac{1}{4}$: and that is the diuidend.

2 1

$\frac{1}{8}$ + $\frac{1}{2}$

$\frac{1}{16}$

Againe, I must adde $\frac{1}{2}$, to $\frac{1}{16}$, and it will be $\frac{9}{16}$, that is the Diuisor. Now I shall diuide $\frac{1}{4}$, by $\frac{9}{16}$, and the quotient will be $\frac{4}{9}$, that is, 1 $\frac{4}{9}$: whereby I know that there was put 1 pound and $\frac{4}{9}$ of siluer into the Crowne, and so much Gold taken out for it.

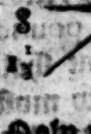
Master. Proue it now by examination, according to the question.

Scholar. If there were 1 pound $\frac{4}{9}$ of siluer, then was there of gold 6 pound $\frac{5}{9}$. Now say I by the Rule of Proportion: If 8 pound of gold expell two pound of water, what shall 6 pound $\frac{5}{9}$ expell?

8 2

6 $\frac{5}{9}$ 1 $\frac{2}{3}$

If




It will be 1 pound $\frac{1}{2}$. Againe If 8 pound of siluer expell 3 pound $\frac{1}{2}$ of water, what shall $1\frac{1}{2}$ expell? It will be $\frac{7}{12}$. Now must I adde together 1 pound $\frac{1}{2}$ and $\frac{7}{12}$, & they will make 2 pound $\frac{1}{12}$, that is 2 pound $\frac{1}{12}$, according to the supposition of the question: whereby I perceiue the worke to be well done. And I cannot but much reioyce of this excellent inuention, so my desire is kindled vehemently to be perfectly instructed in euery part thereof, and namely in this point, whether the proportion betweene water and gold be such, that for 8 pound of gold put into a vessell full of water, there shall runne out two pound of water, & for as much siluer, whether 3 pound $\frac{1}{2}$ of water would auoid.

Master. I perceiue your meaning, and coniecture your imagination to be thus, that if you knew the exact proportion betweene gold and siluer, and water, both in their weight and quantities, then could you easily finde out the mixtures of them, which thing I haue reserued for another worke that intreateth of such matters especially. And at this time you must consider that you learne Arithmeticke, which intreateth of the manner to solue doubtfull questions touching number, without regard what matter is signified by that number: else were it necessary in Arithmeticke to teach all Arts, seeing in it may be moued questions of all Arts.

Note.

But

*But ſeeing you are ſo deſirous to know theſe things, I will tell it you in ſuch a ſort, that you ſhall practiſe your Art in finding it, and propound it in forme of a queſtion. Gold beareth greater proportion to water, then ſiluer doth, and their two proportions be in proportion together, as forty eight to twenty fiue. But to helpe you ſomewhat in this riddle, you ſhall note that the proportion of quick ſiluer vnto water, is the iuſt middle number proportionall in Progreſſion Geometricall betweene the proportion of gold and ſiluer vnto water.*

A queſtion of the proportion of gold, ſiluer and quick-ſiluer, vnto water.

And this proportion is $\frac{25}{2}$. Now if you will know the iuſt numbers of theſe three proportions, then muſt you finde out three numbers in Progreſſion Geometricall, whereof the middlemoſt muſt be $\frac{5}{2}$, and the firſt muſt be vnto the laſt, as 25 to 48. And thus I will leaue you to finde thoſe numbers when you be at leiſure.

Scholar. Yet Sir, I thanke you heartily for thus much, for now I ſee the poſſibility to finde them out. Howbeit, becauſe this queſtion ſeemeth ſtrange, if it might pleaſe you to inſtruct me ſomewhat in the order of working for it, I ſhould the more eaſily finde the true working.

Maſter. You deſire too much if you will ſtudy for nothing: Therefore to occaſion you to ſtudy the better, I will leaue this doubt wholly to your owne ſearch. But as touching the generality of the Rule, Archimedes needed not to take two Maſſes of Gold and

and Siluer equall in weight with the Crowne, for the proportion might as well be found in any other weight, yea, although the Masse of Gold were of one weight, and the Masse of Siluer of another. As for example: If the Crowne were of eight pound weight as I did suppose, and I haue not so much other fine Gold, but onely one pound, and trying that by water, and finding that it doth expell but ¾ of an ounce of water, yet then by it I may inferre, that 8 pound of Gold would expell 6 ounces of water. And likewise of Siluer, whereof if I had but two pound, and find that it doth expel three ounces of water, then might I affirme that 8 pound would expell 12 ounces, that is, one pound weight: and so is it as good as if the three Masses were all of one weight. And thus for this time I will make an end of this other part of Arithmeticke.

Sch. Although I cannot sufficiently thanke you for this, yet your promise made me to looke for the Art of extraction of Rootes, whereof hitherto I haue learned nothing.

Master. I will not breake my promise, but intend (God willing) to performe it within this three or foure moneths, if I perceiue this my paines to be well taken in the meane season. And you shall not repent the tarrying for it: for it shall be increased by the tarrying. And in the meane time, you shall take this Addition, not for the second Part of Arithmeticke which I promised, but for an ang-

augmentation of the firſt part, vnto which I would haue annexed the extraction of Rootes ſquare and cubike, namely for examples of the Statute of Aſſiſe of wood, but that in the ſecond part I muſt write of diuers of the Roots, and thought it beſt to reſerue thoſe Rules alſo with their examples vnto the ſame ſecond part.

Scholar. Sir, although I cannot recompence your godneſſe, yet I ſhall alwayes doe mine endeuour to occaſion you not to repent your benefit on me thus imployed.

Maſter. That recompence is ſufficient for your part.

FINIS.

# The third part

or Addition to this Booke, entreateth of briefe Rules, called Rules of Practiſe, of Rare, Pleaſant, and commodious effect, *abridged into a briefer method then hitherto hath beene publiſhed.*

With diuers other neceſſarie Rules, Tables, and Queſtions, not only profitable for Merchants, *but alſo for Gentlemen*, and all other occupiers *whatſoeuer, as by the* Contents of this *Booke may appeare.*

Set forth by IOHN MELLIS *Schoole-maſter.*

# The third part

# The firſt Chapter of this Addition, entreateth of briefe Rules, called Rules of *Practiſe*, with diuers neceſſary queſtions, profitable *not onely for Merchants, but alſo for all other occupiers whatſoeuer.*

THe working of Multiplication in Practiſe, is no other thing then a certaine manner of multiplying of one kinde by another: whereupon is brought forth the product of the proponed number, which is accompliſhed by the meanes of Diuiſion in taking the *halfe*, the *third*, the *fourth*, the *fifth*, or ſuch other parts of the ſumme, which is to be multiplyed.

*And for the better vnderſtanding of ſuch conuerſions, you ſhall vnderſtand that in the manner and vſe of theſe rules of practiſe, you ought firſt to know the euen or aliquot parts of a ſhilling, which in thie table following doth appeare.*

*Item* { 6 4 3 2 1 } *pence is the* { 1/2 1/3 1/4 1/6 1/12 } *of a ſhilling.*

Wherein as you ſee according to the order

of theſe rules of Practiſe: at 6 pence the yard of any thing, you muſt take $\frac{1}{3}$ of your number which is to bee multiplyed, and the product that commeth thereof ſhall be ſhillings, if any vnite do remaine it is 6 pence.

For 4 d. take the $\frac{1}{3}$ of the number that is to be multiplied, and the product alſo produceth ſhillings, if any vnites doe remaine, each one ſhall be worth in value 4 pence. The like is to be vnderſtood of the other 3, &c.

*I Example.*

At 6 d. the yard, what 379 yards?

189 ſ. —— 6 d

II

At 4 d. the yard, what 104 yards?

34 —— 8 d

III

At 3 d. the yard, what 5014 yards?

1253 ſ. —— 6 d

IIII

At 2 d. the yard, what 532 yards?

88 ſ. —— 8 d

V

At 1 d. the yard, what 409?

34 ſ. —— 1 d

Here you may ſee in the firſt example, that 379 yards at 6 d. the yard, are worth 189 ſ. 6 d. in taking the $\frac{1}{3}$ of 379. And in the ſecond example the 104 yards at 4 pence the yard, are worth 34 ſ. 8 d. in taking the $\frac{1}{3}$ of 104. Likewiſe in the third example, 5014 yards at

3 d

3 d the yard, bringeth forth 1253 ſ 6 d in taking the $\frac{1}{4}$ of 5014 Alſo in the fourth example at 2 d the yard, maketh 88 ſ 8 d.

And laſtly, in the fifth example: 409 yards at 1 d the yard, amounteth to 34 ſ 1 d in taking the $\frac{1}{12}$ of 409: and ſo is to be done alſo of al other queſtiõs the like, when the number of the pence is any of the euen or aliquot parts of 12 d

Item, to bring the products of theſe ſhillings, and al other the like into pounds is very eaſie in diuiding of it in your mind by 20, for it is to be vnderſtood that as often as 20 is found in that product, ſo many pounds doth it containe: which with facility to performe, alwaies ſtrike off the figure towards your right hand, with a right down daſh of your pen, for the o that appertaineth to the 20 And then begin at the left hand, in taking the half of the reſt. And if that at the laſt any vnite doe remaine, the ſame ſhall bee ioyned with the figure that is cut off, which ſhall repreſent the odde ſhillings contained in that worke.

As for example, in your third queſtion at 3 d the yard, which amounteth to 1253 ſ 6 d, the product whereof maketh 62 li 13 ſ 6 d, as here you may ſee, is eaſily performed by this example.

| | |
|---|---|
| 1 | |
| 125 | 3 |
| 62-13 | —6 |

Alſo for the working of one peny the yard, it is ſomething harſh and hard to take the $\frac{1}{12}$ of ſome products: therfore to eaſe that hard worke, you ſhall firſt bring your deliuered

ſumme into groats, by taking $\frac{1}{24}$ part of the product, and if any vnites remaine of that $\frac{1}{24}$ part, as ſometimes there may, they are pence: & muſt be ſignified with a line from the *groats* with their title of *Pence*; and becauſe that 60 *groats* maket a *Pound* or twenty ſhillings, *ſtrike* off the firſt figure toward your right hand, for the 0 that appertaineth to 60 (as you did euen now for the 0 that belongeth to 20:) Then in taking the $\frac{1}{6}$ of that product, if there do remain any vnites, the ſame ſhal you ioyne with the figure that you cut off, eſteeming them as *groats*, which keepe in your minde, & by taking the $\frac{1}{3}$ part of them, you ſhall turne them into *ſhillings*, and ſo haue you done: *As for example*, by a queſtion or two hereafter proponed, ſhall more plainely by the worke appeare.

At 1 d, the yard, what 5 4 2 6 8 yards?

1 3 5 9 | 2 *groats*.

$\frac{1}{6}$ li ——— 226 — 10 ſ. 8 d.

Here in taking the $\frac{1}{6}$ part of 1359, in comming to the laſt worke, the $\frac{1}{6}$ part of 39 being taken, the *remainder* is 3, which ioyned with the two that was cut off, maketh 32 *groats*, which conuerted into *ſhillings* by taking the $\frac{1}{3}$ part, maketh as appeareth 10 *ſhillings* 8 d. Many other wayes there are, but none more apt for a *young learner* to vnderſtand then this: wherefore this one way well impreſſed in memory, is better then 20 wayes doubtfully vnderſtood.

At

At 1 peny the yard, what 4533 yards?

| | | | |
|---|---|---|---|
| 1 | 13 | 3 | groats-1 d |
| ¼ li | | 18 | —17-9 d |

At 1 peny the yard, what 647668 yard?

| | | | |
|---|---|---|---|
| 1 | 619 | 2 | groats |
| li | | 269 | -17-4 d. |

NOw followeth also to bee vndestood that if the number of pence be not an aliquot part of 12, you must reduce them into some aliquot part of 12: and after the aforesaid manner, you shall make of them two or three products, as need shall require, and adde them together into one summe. And here for thy furtherance appeareth a note of the order of their parts, as they are to be taken, 2 Rule.

| for pence | take | and | or | & |
|---|---|---|---|---|
| 5 | 3 | 2 | 4 | 1 |
| 7 | 4 | 3 | 6 | 1 |
| 8 | 4 | 4 | 6 | 2 |
| 9 | 6 | 3 | 4.4 | 1 |
| 10 | 6 | 4 | 4.4 and | 2 |
| 11 | 6 | 4 & 1 | 4 4 | 3 |

Here in the first note of this *Table* at 5 d, you shall first take for 3 d the ¼ of the number that is to be multiplied: and likewise for 2 d, the ⅙ of the same number, adding together both the products: But if you will worke by 4 and 1, you must for 4 d, first take the ⅓ of the number that is to bee multiplied: and for 1 d, take the $\frac{1}{12}$ of the whole summe, or rather, which is more better, for 1 peny you may take the ¼ of the product which did come of the 4 pence:

pence: becauſe that 1 d, is the $\frac{1}{4}$ of 4 pence. The totall ſummes of theſe two numbers ſhall bee the ſolution to the *queſtion*. And in like manner it to be done of all others, as by theſe examples following ſhall appeare.

I

| | |
|---|---|
| At 5 d the yard, what | 748 yards? |
| 3 d | 189 —— 6 d |
| 2 d | 126 —— 4 d |
| ſhillings, | 315 —— 10 d |

*Otherwiſe.*

| | |
|---|---|
| At 5 d the yard, what | 758 yards? |
| 4 d | 252 —— 8 d |
| 1 d | 63 —— 2 d |
| ſhillings | 315 —— 10 d |

II

| | |
|---|---|
| At 7 pence the Ell, what | 552 Elles? |
| 4 d | 187 —— 8 d |
| 3 d | 140 —— 9 d |
| ſhillings | 328 —— 5 d |

III

| | |
|---|---|
| At 8 d the pound, what | 112 pound? |
| 4 d | 37 —— 4 d |
| 4 d | 37 —— 4 d |
| ſhillings | 74 —— 8 d |

*Otherwiſe.*

| | |
|---|---|
| At 8 pence the pound, what | 112 pounds? |
| 6 d | 56 —— 0 |
| 2 d | 18 —— 8 |
| ſhillings | 74 —— 8 d |

IIII

| | |
|---|---|
| At 9 pence the Ell, what | 356 Ells? |
| 6 d | 178——0 |
| 3 d | 89——0 |
| shillings | 267——0 d |

V.

| | |
|---|---|
| At 10 pence the peece, what | 795 peeces? |
| 6 d | 397——6 |
| 4 d | 265——0 |
| shillings | 662——6 |

VI.

| | |
|---|---|
| At 11 pence the pound, what | 7576 pound? |
| 6 d | 2788——0 |
| 4 d | 2525——4 |
| 1 d | 631——4 |
| | 6944——8 d |
| | Pounds 347-4 l-8 d |

1 Here in this first example, where it is demanded (at 5 d. the yard) what will 758 cost? First, for 3 d. I take the $\frac{1}{4}$ of 758: and thereof commeth 189 l. 6 d. Then for 2 d. I take the $\frac{1}{6}$ of the same 758, which amounteth to 126 l. 4 d. these two summes added together, do make 315 *shillings* 10 *pence*: and so much are the 758 *yards* worth at 5 d the *yard*.

1 Item, for the same againe: First for 4 d. I take the $\frac{1}{3}$ of 758; and thereof commeth 252 l. 8 d. then for 1 peny I take the $\frac{1}{4}$ of the same 758, that is to say, of 252 l. 8 d. and it yeeldeth me 63 l. 2 d. which both added together maketh 315 l——10 d. as before.

2 *Item for* 7 d. *there is taken the* $\frac{1}{3}$ *and the* $\frac{1}{4}$ of

the whole ſumme which is to be multiplyed, and adde them together, that is to ſay, firſt, for 4 pence there is taken $\frac{1}{3}$ of 563: which comes to 187 ſ—8 d. as appeareth by the worke, and for 3 d. there is taken the $\frac{1}{4}$ of the whole ſumme, which amounteth to 140 ſ—9 d. Both which products added together, do make 328 ſ–5 d. and ſo much comes 563 *ells* to at 7 d. the *ell*.

3 *Item, for the firſt* 8 d. *there is taken for* 4 d. the $\frac{1}{3}$ of the whole ſum, and another $\frac{1}{3}$ for the other 4 d. which added together, as in the example doth euidently appeare, amounteth to 74 ſ–8 d.

*Againe, for the ſecond worke of* 112 li. there is taken firſt the $\frac{1}{2}$ of the whole ſumme for 6 d. which comes to 56 ſ. then for that 2 d you haue to take $\frac{1}{6}$ of the whole ſumme, or if you will, the $\frac{1}{3}$ of the product that came of 6 d. either of which maketh 18 ſ–8 d. Theſe two ſummes being added together, do make 74 ſ. 8 d. as in the third example appeareth.

4 *Item for* 9 d. *there is taken for* 6 *pence* the $\frac{1}{3}$ of the whole ſumme: and the $\frac{1}{4}$ of the whole ſumme for 3 d. or otherwiſe for the 3 d. you may take the $\frac{1}{2}$ of the product that came of 6 d. becauſe 3 pence is the $\frac{1}{2}$ of 6 d. which added together, as plainly appeareth in the *fourth example*, amounteth to 267 ſ. 0 d.

*Item, for* 10 d. *firſt there is taken for* 6 d. the $\frac{1}{3}$ of the whole ſumme, which amounteth to 397 ſ–6 d. Then for 4 d. there is found 265 ſ. both

both which added together, make 652 shillings, 6 d. as appeareth in the *fifth example*. It may also be wrought, *as appeareth by the second note in the Table*, by 4 d. twice taken, and the $\frac{2}{3}$ of the product of 4 d. or else by the $\frac{1}{2}$ of the whole summe, &c.

*Item, for* 11 d *there is first taken the* $\frac{1}{3}$ *for* 6 d then the $\frac{1}{3}$ of the whole summe for 4 d. Lastly, the $\frac{1}{4}$ of the last product for 1 d. All which 3 summes added together, maketh in shillings 6944 ſ-8 d. and in pounds 347-4 ſ-8 d.

*Item, likewise by the same reason, when you will multiply (by shillings) any number that is vnder* 20 ſ. *you shall haue in the product pounds, if you know the euen or aliquot parts of* 20, *which are here in this little Table set downe to sight.*

Item ſ { 10, 5, 4, 2, 1 } is the { $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$, $\frac{1}{20}$ } of one pound.

*So that for* 10 ſ. *which is the* $\frac{1}{2}$ *of a pound*, you may take the $\frac{1}{2}$ of the number which is to bee multiplied, and you shall haue in your product pounds: if an vnite do remaine, it shall bee worth 10 *shillings*.

*Likewise for* 5 *shillings you must take the* $\frac{1}{4}$ of the number which is to be multiplyed, and if there do remaine any *vnites*, they shall bee fourth parts of a *Pound*, euery vnite being in value fiue *shillings*.

*For* 4 *shillings take the* $\frac{1}{5}$ *of the number* which is

is to be multiplied: and if there do remaine any *vnites*, they shall bee fift parts of a *Pound*, each vnite being in value 4 *shillings*.

*For* 2 *shillings you must take the* $\frac{1}{10}$ *of the* number to be multiplyed, wherefore to take the $\frac{1}{10}$ of any number, you must cut off the last figure of the same number (which is neareſt your right hand) from all the other figures with a small right downe line or dash with a pen, and so haue you done: for all the other figures which do remaine toward your left hand from the same figure that you do separate, shall be the said $\frac{1}{10}$ of a *pound*: and that figure so separated towards your right hand, shall be so many peeces of 2 s. the peece, the which figure you must double to make thereof the true number of shillings, as by the example shall appeare.

*Finally for* 1 *shilling needeth small worke*, for it is so many shillings as bee proponed in the summe, which to bring into pounds, hath been already taught in the *first rule*.

*Example.*

| | | |
|---|---|---|
| At 10 s. the peece, What | | 6543 peeces? |
| $\frac{1}{2}$ | li | 3271 10 s. |
| At 5 s. the Ell, What | | 4373 Ells? |
| $\frac{1}{4}$ | li | 1093. 5 s. |
| At 4 s the yard, what | | 7839 yards? |
| $\frac{1}{5}$ | li | 1567. 16 s. |
| At 2 s the pound weight, What | | 752 \| 7 pound |
| $\frac{1}{10}$ | li | 752. 14 s. |

At

At 1 ſ the peece, What 757 | 3 peeces
$\frac{1}{20}$ li 378 13 ſ.

NExt, followeth in order to be vnderſtood, that if the number of ſhillings be not ſome euen or aliquot part of 20, you muſt then conuert the ſame number of ſhillings into the aliquot parts of twenty, and thereof make two or three products as need ſhall require: which done, adde them together, and bring them into Pounds. And here for thy furtherance I haue ſet downe a note of the order of their parts, as they are to be taken. 4 Rule.

| ſ | | | | ſ | |
|---|---|---|---|---|---|
| 5 | 2£1 | | 13 | 10.2 | £1 |
| 6 | 4£2 | 5£1. | 14 | 10. | £4 |
| 7 | 5£2 | | 15 | 10. | £5 |
| 8 | 4£4 | 5.2.1 | 16 | 10. | 5.1 |
| 9 | 5£4 | 4.4.1 | 17 | 10. | 5.2 |
| 11 | 10£1 | | 18 | 10. | 4.4 |
| 12 | 10£2 | | 19 | 10. | 5.4 |

*For* 3 ſ *according to the tennor that you ſee is* expreſſed in the Table, you muſt firſt take for 2 *ſhillings* the $\frac{1}{10}$ of the number that is to bee multiplied. Then for one *ſhilling* you muſt take the $\frac{1}{2}$ of the product which did come of the ſame $\frac{1}{10}$ part: which two ſummes added together produceth the effect deſired.

*Item, for* 6 *ſhillings according to the note* ſet forth in the table firſt, for 4 ſ I take the $\frac{1}{5}$ of the number

number that is to bee multiplied: Then for 2 s, the $\frac{1}{3}$ of the product that came of 4 s, and adde them together.

*Or else as appeareth also in the Table, for 5 shillings* you may take the $\frac{1}{4}$ and the $\frac{1}{5}$ part of the product that came of 5 *shillings*, and adde them together.

*Item, for 7 l, first for 5 l, take* $\frac{1}{2}$ *of the product* that is to be multiplied, then for 2 l, take the $\frac{1}{10}$ of the number that is to be multiplied, and adde them together, &c.

*Item, for 8 s, according to reason, and the* intent of the *Table*, for the first 4 l, take the $\frac{1}{5}$ of the product, and the same number againe for the other 4 shillings, and adde them together.

*Item, for 9 shillings: first for 5 shillings*, take *the* $\frac{1}{4}$, then for 4 shillings take the $\frac{1}{5}$, and adde them together.

*Otherwise as you see by the intent of the Table*, work twice for 4 shillings as was taught euen now for 8: and then take the $\frac{1}{2}$ of the last product for the 1 shilling: but 5 and 4 is the shorter.

*Item, for* 11 s, *first dispatch* 10 *shillings*: for which you must take the $\frac{1}{2}$ of the product, then lastly, for 1 shilling take the $\frac{1}{10}$ part of the summe produced of the $\frac{1}{2}$ of the product, and adde them together.

*Item, for* 12 *shillings, where I will end with the first part of my Table.* First take the $\frac{1}{2}$ for 10 *shillings*. And then for 2 *shillings*, take the $\frac{1}{5}$ of the summe that came of 10 *shillings*, take and

adde

adde them together, or else if you please for 2 shillings, you may take the $\frac{1}{10}$ of the whole giuen number.

To write more of the manner of taking the true parts, I omit. The desirous practitioners will no doubt conceiue it. Also the *Table* is some aide to helpe the vnperfect, whereupon by and by I will set downe three or foure of these notes in *Examples*, and the rest I will leaue to thine owne industrie and practise, to labour vpon.

This is the order most commonly vsed in practise, when the number of shillings is not an *aliquot* part of a pound. But (*louing Reader*) after I haue touched the euen or aliquot parts of a pound that falleth out in pence and shillings, I will deliuer two new rules, that shall drowne this common order quite and cleane: wherein shall be comprehended in one line, or working both of euen and odde parts of shillings vnder 20, without regard whether it be an *aliquot*, or not an *aliquot* part: which two Rules (when they come in place) I commit to thy friendly iudgement in working.

Now follow the examples vpon the notes beforesaid.

| | |
|---|---|
| At 6 shillings the yard, What | 3215 yards? |
| 4 shillings | 643 |
| 2 shillings | 321—10 |
| | 964—10 *l.* |

*Otherwise by Multiplication of 6.*

3215

6 *shillings* 1929 | 0

li ——— 964 —— 10 *shillings.*

| | |
|---|---|
| At 7 shillings the Ell, What | 4563 Ells? |
| 5 shillings | 1140 —— 15 |
| 2 shillings | 456 —— 6 |
| li | 1597–1 shilling |

*Otherwise by Multiplication of 7*

4563

7 l 3194 | 1

1597 —— 1

| | |
|---|---|
| At 8 l. the peece, What | 7563 peeces? |
| 4 l | 1512. 12 |
| 4 l | 1512. 12 |
| Pounds | 3025. 4 l |

*Otherwise by Multiplication.*

7563

8 l 6050 | 4

Pounds 3025–4 shillings.

| | |
|---|---|
| At 13 l. the peece, what | 401 peeces? |
| 10 l | 200 —— 10 |
| 2 l | 40 —— 2 |
| 1 l | 20 —— 1 |
| Pounds | 260 —— 13 |

*Other-*

*Otherwise by Multiplication.*

| | | |
|---|---|---|
| | 401 | |
| 13 s. | 1203 | |
| | 401 | |
| | 521 3 | |
| Pounds | 260 — 13 s. | |

These and such like questions of compound numbers, which I haue here in this fourth rule for orders sake set downe, for that it hath beene heretofore a common course of worke; I account but superfluous. For in the eighth and ninth rules of this my simple Addition shall appeare, that the given price of any euen or odde number of shillings, either vnder or aboue 20, shall bee wrought at one or two workings at the most, how difficult soeuer the question be.

5 Rule. To reduce pence into pounds at one operation.

*Item, there resteth yet a kinde of practise, how to bring Pence into Pounds at the first working: whereupon you must vnderstand that* 240 *pence maketh one pound, or* 20 s. *In consideration whereof I cut off the last figure or* 0, *and there remaineth but* 24 (*of which* 24) 8 d. *is the* $\frac{1}{3}$ *part thereof,* 6 d. *is the* $\frac{1}{4}$ *part,* 4 d. *is the* $\frac{1}{6}$ *part, and* 2 *pence is the* $\frac{1}{12}$ *part thereof.*

Whereupon if it were demanded what 1486 yards or pounds of any thing commeth to, at 8 pence the yard; in pricking or cutting off the first figure towards your right hand, for

the 0 that appertaineth to 240. There is remaining of the said summe 148, whereout I taking the $\frac{1}{3}$ part, and it commeth to 49 li. and there resteth 1, which I I put to the 6, that I pricke or cut off, and it maketh 16 peeces of 8 pence, which I double to make into groats, and they make 32, whereof the $\frac{1}{3}$ part maketh 10 s. and there remaineth $\frac{2}{3}$ s. which is 8 pence, whereby it followeth, that the 1489 yards at 8 pence the yard, maketh 49 li. 10 s. 8 d. as by the example shall appeare.

Item, for 6 pecne, take $\frac{1}{4}$ part of the number from the prickt figure; and if any vnites do remaine, they are so many six pences, whereof taking the $\frac{1}{2}$ they are shillings, if there do remaine yet one, it is in value six pence.

Item, for 4 d. take the $\frac{1}{6}$ part of the number from the prickt figure: If any vnites remaine, they are so many groats, which to conuert into shillings, take the $\frac{1}{3}$ part. And if any thing yet remaine, they are thirds of shillings, each one in value being worth 4 pence.

Item for three pence, take the $\frac{1}{8}$ part from the prickt figure, if any vnites remaine, they are so many peeces of 3 pence, whereof in taking the $\frac{3}{4}$ part, maketh shillings: If any thing yet remaine, they are fourth parts of shillings each one being in value 3 pence.

Item, for 2 pence, as appeareth also by the table, take the $\frac{1}{12}$ part of the number from the prickt figure: if any thing remaine, they are so

ſo many peeces of 2 pence, which by taking the $\frac{1}{6}$ part, you ſhall turne into ſhillings: and if any vnites remaine, they are ſo many ſixt parts of ſhillings, or peeces of two pence, whether you will.

| | |
|---|---|
| *If* one coſt 8 pence, what maketh pounds | 148 \| 6? 49—10—8 d. |
| *If* one coſt 6 pence, what maketh pounds | 786 \| 5? 196—12—6 d |
| At 4 pence the yard, what maketh pounds | 873 \| 6 yards? 145—12—0 d |
| *If* one coſt 3 pence, what maketh pounds | 987 \| 4 worth? 123—8—6 d |
| At 2 d. the Ell, what maketh pounds | 789 \| Ells for? 65—15—8 d. |

BVt *if your number of pence bee not an aliquot or euen part of* 24: *then muſt you bring them into the aliquot parts of* 24, *and make thereof diuers products which muſt be added together, as by the queſtion hereafter following ſhall appeare.* 6. Rule

*Item* for 5 d. firſt take for 3 d. then for 2 d. and adde them together, according to the inſtruction of the *ſecond Rule*: Or elſe firſt take for 4 d. then for 1 d.

*Item* for 7 d. firſt take for 4 d. then for 3 d. and adde them together.

*Item* for 9 d. firſt take for 6 d. then for 3 d.

and adde them together.

Item for 10 d. first take for 6 d, then for 4 d. and adde them together.

Item for 11 d. first take for 8 d. then for 3 d. & adde them together: as by these examples.

*Examples.*

1. If one yard cost 5 d. what 759|6

| | |
|---|---|
| 4 pence | 126-12 |
| 1 peny | 31—13 |
| maketh pounds | 158—5 |

*Otherwise.*

1——5——759|6

| | |
|---|---|
| 3 pence | 94—19 |
| 2 pence | 63—6 |
| maketh pounds | 158—5 s. |

2. If one cost 7 d. what 98|7 worth

| | |
|---|---|
| 4 pence | 16-9 |
| 3 pence | 12-6-9 |
| maketh pounds | 28-15-9 d. |

*Otherwise.*

1——7——98|7

| | |
|---|---|
| 6 pence | 24-13-6 |
| 1 peny | 4—2-3 |
| maketh pounds | 28-15-9 d. |

3. If one cost 9 d. what 98|7 worth

| | |
|---|---|
| 6 pence | 24—13-6 |
| 3 pence | 12—6—9 |
| maketh pounds | 37—0-3 d. |

*Other-*

*Otherwise,*

| | | |
|---|---|---|
| | 1——9——98\|7 | |
| 6 pence | | 24-13-6 |
| 3 pence | | 12-6-9 |
| maketh pounds | | 37 00 3 |

4. If one coſt 10 pence, what 98|7?

| | |
|---|---|
| 6 pence | 24-13-6 |
| 4 pence | 16—9-0 |
| maketh pounds | 41—2-6 |

5. If one coſt 11 pence, what 98|7?

| | |
|---|---|
| 8 pence | 32-18-0 |
| 3 pence | 12—6-9 |
| maketh pounds | 45—6-9 |

But if you haue any ſhillings and pence to be multiplied together: Then are you to take for the ſhillings according to the inſtruction of the third rule: and for the pence according to the firſt rule before mentioned: vnleſſe you can ſpie the aduantage thereof, and thereby helpe your ſelfe: as appeareth in this ſecond example, where firſt I worke for 6 d. which is to be rebated out of the giuen number, and I haue 719 li. 11 ſ. my deſire.

At 19 ſ 6 d the yard, what 738 yards?

| | | |
|---|---|---|
| | 738 | *Otherwiſe by* |
| 10 ſ | 369 —— 1 | *Rebating.* |
| 5 ſ | 184-10 | 738 |
| 4 ſ | 144-12 | 6 d 18-9 ſ |
| 6 d | 18—9 | 717 19—11 |
| pounds | 719—11 ſ | |

The like againe is done by rebating, as by theſe two examples appeareth.

At 18 ſ. the Ell, what 418 Ells?

| | |
|---|---|
| | 41 —— 16 |
| 2 ſ | 376 —— 4 ſ |
| pounds | |

At 16 ſ. the Ell, what 517 Ell?

| | |
|---|---|
| 4 ſ | 103 —— 8 |
| pounds | 413 —— 12 ſ |

7 Rule. *And now I will touch a little the euen part of a pound, that falleth out in pence and ſhillings, whereof for theſe parts you ſhall take ſuch like part out of the giuen number that is to be multiplied, as the price of that giuen number beareth in proportion to a pound, which alſo for their better aide is here ſet downe.*

| | | | |
|---|---|---|---|
| 1 ſ 8 d | | $\frac{1}{12}$ | |
| 2 6 | *is the* | $\frac{1}{8}$ | *part of a pound.* |
| 3 4 | | $\frac{1}{6}$ | |
| 4 8 | | $\frac{1}{5}$ | |

Item, firſt for 1 ſhilling 8 pence take the $\frac{1}{12}$ part

part of the giuen number, and if any thing do remaine, they are twe'ue parts of a pound, each one being in value 1 ſhilling 8 pence.

Item, for 2 ſhillings 6 pence, take the $\frac{1}{8}$ part of the number that is to be multiplied. And if any thing do remaine, they are eight parts of a pound, each one being in value 2 ſhillings 6 pence.

Item, for 3 ſhillings 4 pence, as appeareth by the Table, you muſt take the $\frac{1}{6}$ part of the giuen number, and if any thing do remaine, they are 6 parts of a pound, each one being in value 3 ſhillings 4 pence.

Item, for 6 ſhillings 8 pence, take the $\frac{1}{3}$ part of the number that is to be multiplied: And if any vnites do remaine, they are thirds of a pound, euery one being worth 6 ſhillings 8 pence.

Other infinite numbers there are, that may be reduced by abreuiation into the proportionate parts of *a pound*, as 16 ſhillings 8 pence maketh $\frac{5}{6}$: which 16 ſhillings 8 pence is eaſily reduced into groats, by multiplying 16 by 3, and thereto adde 2, which maketh 50 groats.

Then ſet 60 the groats of a pound vnder 50: cutting off the 2 ciphers, as is here performed.

And then haue you brought 16 *ſhillings* 8 d into the knowne parts of a *pound*, which maketh $\frac{5}{6}$.

16—8
3
50
6|0

But

But yet Gentle Reader, for thy further instruction, I haue hereunto annexed in a Table, how pence and shillings beare proportion to a pound, which I commit to thy friendly beneuolence; it will be some aid vnto the vngrounded Practitioner: but I count him the best workman that can presently reduce his giuen price into the knowne and proportionate parts of a pound



# A Table of the aliquot parts of a pound, or 20 shillings.

| s | d. | £ |
|---|---|---|
| 0 | 2 | 1/120 |
| 0 | 3 | 1/80 |
| 0 | 4 | 1/60 |
| 0 | 6 | 1/40 |
| 0 | 8 | 1/30 |
| 1 | 0 | 1/20 |
| 1 | 3 | 1/16 |
| 1 | 8 | 1/12 |
| 2 | 0 | 1/10 |
| 2 | 6 | 1/8 |
| 3 | 0 | 3/20 |
| 3 | 4 | 1/6 |
| 3 | 9 | 7/40 |
| 4 | 0 | 1/5 |
| 5 | 0 | 1/4 |
| 6 | 0 | 3/10 |
| 6 | 3 | 7/20 |
| 6 | 8 | 1/3 |
| 7 | 0 | 7/30 |
| 7 | 6 | 3/8 |
| 8 | 0 | 2/5 |

| s | d | £ |
|---|---|---|
| 8 | 4 | 1/12 |
| 8 | 9 | 7/16 |
| 9 | 0 | 9/20 |
| 10 | 0 | 1/2 |
| 11 | 0 | 11/20 |
| 11 | 3 | 7/16 |
| 12 | 8 | 3/5 |
| 12 | 0 | 13/20 |
| 13 | 0 | 2/3 |
| 13 | 4 | 11/16 |
| 13 | 9 | 7/10 |
| 14 | 0 | 3/4 |
| 15 | 0 | 4/5 |
| 16 | 0 | 1/6 |
| 16 | 8 | 17/20 |
| 17 | 0 | 7/8 |
| 17 | 6 | 9/10 |
| 18 | 0 | 11/12 |
| 18 | 4 | 15/16 |
| 18 | 9 | 19/20 |
| 19 | 0 | |

## Here follow foure examples vpon the foure notes deliuered.

| | |
|---|---|
| At 1 ſ. 8 d. the yard, what | 3884 yards? |
| maketh pounds | 323—13-4 d. |
| At 2 ſ 6 d. the yard, what | 4563 yards? |
| maketh pounds | 570—7—6 d |
| At 6 ſ 8 d. the Ell, what | 7562 Ells? |
| maketh pounds | 2520-13-4 d |

*Now by custome you are able to worke by all sorts of summes being deliuered in shillings and pence, as one shilling one penie, two shillings two pence, three shillings three pence, and so of all other: wishing you to haue some consideration of your questions, when they are set downe, for there are many subtill abbreuiations, and great aduantages to bee gotten, and easily to bee perceiued.*

As of 3 ſ—8 d. of 2 ſ. and 1 ſ. 8 d.
Of 4 ſ—2 d. of 3 ſ—4 d. and 10 d. which 10 d is $\frac{1}{4}$ of 3 ſ—4 d.
Of 5 ſ—8 d. of 4 ſ. 1 ſ-8 d.
Of 5 ſ 10 d. of 5 ſ. and 10 d. which 10 d is $\frac{1}{6}$ of 5 ſ.

And by this meane when you haue taken one product, you may oftentimes vpon the ſame take another more briefly then vpon the ſumm

ſumme which is to be multiplied, &c.

NOw (*Gentle Reader*) *that you haue ſeene the vertue of the euen or aliquot parts of a pound in ſhillings alone, and alſo in the aliquot parts of ſhillings and pence: according to my promiſe hereafter followeth a briefe and eaſier method for any euen number of ſhillings, either vnder or aboue* 20, *then euer yet hath beene publiſhed*; *Notwithſtanding*, M. Humfrey Baker, *whoſe trauell is worthy commendation, and whom for knowledge ſake I reuerence, hath in ſome part touched this firſt part, though not in this method. The worke of the rule both pleaſant, ready, and briefe, as by the variety of the examples deliuered therepon ſhall appeare. And firſt I will ſet forth a queſtion, thereby the better to expreſſe or teach you the order thereof*; *which is this.* 8 Rule.

If one coſt 6 ſ. what 8574?

| 1 | 6 | 8574 |
|---|---|---|
| maketh pounds | | 2572-4 ſ. |

To the vnderſtanding of this example, after you haue ſet downe your giuen number in forme of the rule of 3, with a line drawne vnder it, you ſhal preſently ſet a prick vnder your firſt figure 4. towards your right hand drawing from the pricke, as heretofore hath beene practiſed, a little ſhort line, thereto ſet downe the Mr. IOHN MELLIS *his firſt rule*

the ſhillings aboue, which done, multiply the firſt figure 4 by 6, the value of your price; (which here you ſee ſtandeth in ſight aboue the line) it maketh 24, which is one pound foure ſhilling. The one pound keepe to carry to the next place, and the foure ſhillings ſet downe at the end of the preſcribed line towards your right hand. Thus haue you done now with 6 aboue the line, and alſo with 4 in the firſt place (for the pricke vnder 4 doth ſignifie that 4 hath done his office) Then ſecondarily for a generall rule take but the ½ of the giuen price, which here is 3, which 3 is the number that ſhall now continue the reſt of the multiplication and end the worke, whereupon I multiply 3 into 7, ſtanding in the ſecond place it maketh 21, and with the one pound I kept in minde 22; ſet downe 2, and keepe 2 in minde, working according to the rule of multiplication, deliuering the tenths in minde in their due place, which done, the product from the pricke to your left hand repreſenteth the pounds, and the other at the end of the line the ſhillings, as appeareth by the examples.

Note a generall rule.

| | |
|---|---|
| If one yard coſt 2 ſ. what | 7536 ſ. |
| 1 2 | 7536 |
| maketh pounds | 753—12 |
| If one yard coſt 4 ſ. what | 8792 ſ. |
| 1 4 | 8792 |
| maketh pounds | 1758—8 ſ. |

If one peece coſt 6 ſ. what 9537?

| 1 | 6 | 9537 |
|---|---|---|
| maketh pounds | | 2861—2 ſ |

If one peece coſt 8 ſ. what 7509?

| 1 | 8 | 7509 |
|---|---|---|
| maketh pounds | | 3003—12 ſ |

If one coſt 12 ſ. what 5794?

| 1 | 12 | 5794 |
|---|---|---|
| maketh pounds | | 3476—8 ſ |

If one coſt 14 ſ. what 3705?

| 1 | 14 | 3705 |
|---|---|---|
| maketh pounds | | 2593—10 ſ |

If one coſt 18 ſ. what 5703?

| 1 | 18 | 5703 |
|---|---|---|
| maketh pounds | | 5132——14 ſ |

If one coſt 22 ſ. what 953?

| 1 | 22 | 953 |
|---|---|---|
| maketh pounds | | 1048—6 ſ |

Let theſe ſuffice (gentle Reader) for an entrance into euen numbers. And now I will ſhew the like rule for any odde or vneuen part of a pound.

*TO helpe you to the vnderſtanding of theſe other queſtions that hereafter follow: where in my firſt example the giuen number is* 6487 Rule 9.

3 ſ.

3 ſ. the yard: I multiply 3 aboue the line into 7, it maketh 21. The one ſhilling is ſet downe, and the 1 pound I keepe. Now am I to take the $\frac{1}{3}$ of three, which becauſe it is an odde number I cannot.

Mr. IOHN MELLIS his ſecond rule.

Therefore I ſhall keepe and continue my multiplication by three ſtill, and worke by the $\frac{1}{3}$ of the reſt of the giuen figures or number, to wit, 648. And firſt the $\frac{1}{3}$ of 8 which is 4 multiplied into 3, maketh 12, there to ioyne the 1 li. in minde, it maketh 13. ſet downe 3, keepe one. Then againe multiply by two the $\frac{1}{3}$ of foure, it maketh ſixe, and with one in minde it maketh 7. Then laſtly, take the $\frac{1}{3}$ of ſixe, which is 3, ſaying, 3 times 3 is 9, which 9 ſet down, and ſo is the queſtion anſwered, as appeareth by the practiſe, and examples following.

At 3 ſ. the yard, what 6487?

| 1 | 3 | 6487 |
|---|---|---|
| maketh pounds | | 973—1 ſ. |

If one yard coſt 5 ſ. what 4269?

| 1 | 5 | 4269 |
|---|---|---|
| maketh pounds | | 1067—5 ſ. |

At 7 ſ the Ell, what 6489?

| 1 | 7 | 6489 |
|---|---|---|
| maketh pounds | | 2271—3 ſ. |

If one Ell coſt 9 ſ. what 2807?

| 1 | 9 | 2807 |
|---|---|---|
| maketh pounds | | 1263—3 ſ. |

At 11 s. the Pistolet, what 8263?

| 1 | 11 | 8263 |
|---|---|---|
| maketh pounds | | 4544-13 £ |

If one peece cost 13 £ what 4629?

| 1 | 13 | 4629 |
|---|---|---|
| maketh pounds | | 3008—17 £ |

But now note (gentle Reader) when the giuen price falleth vpon an odde number, as 3,5,7 11,13. &c. then it is to be presupposed that the giuen summe to be multiplied, must be a summe made of euen numbers, as 2, 4, 6, 8, 10, &c. else cannot that question bee wrought at one line or working.

Prouiding alwayes that it may beare an odde figure in the first place towards your right hand, as appeareth in these sixe examples, which last were wrought, and such like, &c. which may beare an odde number for the price, and be done at one line or working very well.

But if the giuen price be an odde number, and the summe to be muliplied, odde numbers also: then can it not be done at one working, but requireth the aid of two workings, for odde with odde will not agree, which notwithstanding to bring to passe, take this for a generall rule. First worke for the euen number, contained in that question, or giuen price, according as you haue learned, and then

A generall rule.

afterwards for the one odde shilling, take the $\frac{1}{20}$ of the summe giuen to be multiplied, omitting the first prickt place, as was taught for the working of one shilling in my first rule of Practise, and adde those two together, and you shall haue your desire.

*Example.*

| | | |
|---|---|---|
| At 3 s. the yard, what | 7539 yards? | |
| 2 s | 753- | 18 |
| 1 s | 376 | 19 |
| maketh pounds | 1130 | 17 |

| | | |
|---|---|---|
| At 7 s the Ell, what | 7539? | |
| 1 | 7 | 7539 |
| 6 s | | 2261 | 14 |
| 1 s | | 376 | 19 |
| maketh pounds | | 2638 | 13 |

| | | |
|---|---|---|
| At 13 s the yard, what | 7534? | |
| 12 s | 4520- | 8 |
| 1 s | 376- | 14 |
| maketh pounds | 4897- | 2 |

Note this well.

*And thus haue I abridged into these two Rules how to bring any number of shillings, whatsoeuer they be, into pounds, with a briefer Method, then euer yet hath beene published, which I commend vnto thy friendly censure and iudgement in the vse and practise thereof.*

If

| | |
|---|---|
| If one coſt 6 ſ. 5 d. what | 1231? |
| 6 ſ | 369—6 |
| 4 d | 20-10-4 |
| 1 d | 5-2-7 |
| maketh pounds | 394-18-11 |

| | |
|---|---|
| At 14 ſ 2 d. what | 2825? |
| 14 ſ | 1977-10 |
| 2 d | 23-10-10 |
| maketh pounds | 2001—0-10 |

| | |
|---|---|
| At 16 ſ. 4 d. what | 2531? |
| 16 ſ | 2024-16 |
| 4 d | 42—3-8 d. |
| maketh pounds | 2066—19-8 |

| | |
|---|---|
| At 3 ſ the Piſtolet, what | 8325? |
| maketh pounds | 1248—15 ſ |

832.15
416

| | |
|---|---|
| At 7 ſ the crowne, what | 6529? |
| | 2285—3 ſ |

| | |
|---|---|
| At 9 ſ the peece, what | 6567? |
| maketh pounds | 2955—3 ſ |

These three laſt queſtions may ſeeme ſomething harder, yet they are eaſie enough, if you marke them well: if I ſhould explaine them, then are they too eaſie. Therefore I leaue them to whet the mindes of the deſirous.

10 Rule. *ITem, when any one of the summes, which is to be multiplied, is composed of many denominations, and the giuen number but of one figure alone; then shall you multiply all the denominations of the other summe by the same one figure, beginning first with that summe which is least in value toward your right hand, and bring the product of those pence into shillings, and the product of the shillings into pounds, as by this example appeareth.*

At 3 li. 7 s. 4 d. a yard, what are 9 worth?
maketh pounds 30—6 s—0 d

11 Rule. *BVt if in any of the summes that are to be multiplied, there be a broken number, First worke for the whole according to the instructions that you haue learned, and then take such part of the giuen price, as that broken number beareth in proportion to the price, as in the examples following. After you haue wrought for 3 s. and for 6 d. then are you to take the ½ of 3 s. 6 d. for the ½ yard, and adde that to the summe: So adding all the 3 products together, which make 43 li 2 s. 9 d. the iust price of 245 ½ ells, and thus must you do of all other.*

| | |
|---|---|
| At 3 s. 6 d. the Ell, what | 246 ½? |
| 3 s. | 36—18 |
| 6 d. | 6—3 |
| ½ | 1—9 |
| maketh | 43—2—9 |

At

| | |
|---|---|
| At 16 s. 4 d. the peece, what | 14 $\frac{3}{4}$? |
| 16 s | 11—4 |
| 4 d | 0—4-8 |
| $\frac{1}{4}$ | 12-3 |
| maketh pounds | 12-0-11 |

If one peece cost 4 li. 3 s 6 $\frac{1}{2}$ d. what 12 peeces?

| | |
|---|---|
| 4 li. | 48— |
| 3 s | 1—16- |
| 6 d | 6—6 |
| $\frac{1}{2}$ | 6 |
| maketh pounds | 50—2—6 |

*The proofe.*

If 12 peeces cost 50 li. 2 s. 6 d. what one peece?

maketh pounds 4—3—6 $\frac{1}{2}$.

*Item, touching the manner how to vnderstand the order of this question, and others the like,* 12 Rule.
*first seeke how many times* 12 *is contained in* 50, *which is* 4 *times, and so resteth* 2 *pound, which* 2 *pound conuerted into shillings, and ioyned with the other* 2 *shillings, maketh* 42 *shillings: wherein is found* 12, *three times, resteth* 6 *shillings, which turned into pence, putting thereto the* 6 *pence in the first place, it maketh* 78, *wherein* 12 *is found* 6 *times, resteth* 6 *pence: which containeth* 12, *but* $\frac{1}{2}$ *a time: put that* $\frac{1}{2}$ *to the* 6 *pence, and then the solution is* 4 li. 3 s. 6 $\frac{1}{2}$ d. *as appeareth by the practise thereof.*

13 Rule. *Item, the like is to be done of any thing that is bought or sold after fiue score to the hundreth, or the Quintall. As for example.*

If 100 pound cost 27 li. 13 s. 4 d. what one pound?

27 li—13 s—4 d

20

s 5 | 53

| 12

1 | 10

5 | 3

d 6 | 4 | 0

| 10 | 0 or $\frac{2}{3}$

Maketh 5 s $6\frac{2}{3}$ d.

I haue wrought this at length for the aid of the yong learner, because he should vnderstand how all the Multiplication is set downe.

But to worke it more neatly it is by a little vnderstanding ended thus.

27 li.-13 s-4 d

20

15 | 53

| 12

d 6 | 40

| 100

Maketh 5 s. $6\frac{2}{3}$ d.

☞ *Item, to the vnderstanding of this and such like questions, the right down line is all the guide, which is pulled downe close by* 20, *as you see in the example, where* 27 *pound* 13 *shillings is reduced all into shillings, and maketh* 553 *shillings.*

*The* 5 *towards the left hand being separated with the hanging or right downe line, is the iust*

number

*nmmber of ſhillings that anſwereth to the queſtion. Nextly, 53 ſhillings is multiplied by 12, to reduce them to pence, putting to the 4 d. it yeeldeth for the multiplication of the firſt figure two 110: the one beyond the line towards the left hand, is 1 peny towards the reſt of the price: then 53 alſo multiplied by 1 yeeldeth 53: but the 5 behinde the line toward the left hand, is alſo 5 pence more, towards the price, which 1 and 5 I adde together vnder the line, it maketh 6 d. So is there found now, as appeareth by the Tides of ſhillings and pence, 5 ſhillings 6 pence.*

*Finally, I come now on this ſide the line towards the right hand, and vnder 12 I finde firſt 10, and then 3, which added together maketh 40, vnder which 40, you muſt put the 100, and it maketh $\frac{40}{100}$, which abreuiated, cometh to $\frac{2}{5}$. So the iuſt price of one pound after 5 ſcore to the hundred, maketh 5 ſ. $6\frac{2}{5}$ d.* One example more, and ſo I will leaue this rule.

If 100 coſt $10\frac{3}{4}$ d. what 9874?

| | |
|---|---|
| 6 d | 246—17 |
| 4 d | 164—11-4 |
| $\frac{2}{4}$ d | 20—11-5 |
| $\frac{2}{4}$ d | 10—5-8$\frac{1}{3}$ |

Maketh { li. / ſ / d }

| | | | |
|---|---|---|---|
| 4 | 42 | 5 | 5$\frac{1}{2}$ |
| | 20 | | |
| 8 | 45 | | |
| | 12 | | |
| 5 | 45$\frac{1}{3}$ | 91 | |
| | 100 | 100 | |

parts of a peny.

Also the like may bee done of the vsuall weights here in England (which is 112, for euery hundreth weight) in case you know the aliquot parts of a hundreth weight, which are these, 56 li. 28 li. 14 li. and 7 li. For 56 li. is the $\frac{1}{2}$ of 112 li. 28 li. is the $\frac{1}{4}$ of 112 li. 14 li. is the $\frac{1}{8}$ and 7 li. is $\frac{1}{16}$ part.

Therefore for 56 li. take the $\frac{1}{2}$ of the summe of money that 112 li. weight is worth.

For 28 li. take the $\frac{1}{4}$ of the summe of money that 112 li. weight is worth.

For 14 li. take the $\frac{1}{8}$ of the summe that 112 li. is worth.

And for 7 li. the $\frac{1}{16}$ of the summe of money that 112 li. is worth.

As for example: At 17 li. 19 s. the hundreth pounds weight, that is to say, the 112 li. what shall 3 quarters and 7 pound cost?

| 1 C.—17 li.—19 s | | | 3 q.—7 li. |
|---|---|---|---|
| 2 quarterons | 8 | 19 | 6 |
| 1 quarterne | 4 | 9 | 9 |
| 7 pounds | 1 | 2 | $5\frac{1}{4}$ |
| Maketh pounds | 14 | 11 | $8\frac{1}{4}$ |

The

# The second Chapter intreateth of the Reduction of diuers measures to others value by Rules of Practise.

NOw will I shew a few examples of Practise in reducing of measures, as Ells, Yards, Braces, Pawnes of Genes, &c. Much more would I haue touched, but that I feare the booke will rise to too great a volume. 14 Rule.

In 864 Ells of Antwerpe, how many yards of London?

| | |
|---|---|
| 864 | 864 |
| 432 | 216 |
| 216 | 648 |

maketh 648 yards of London.

ITem in these and such like questions of Flemmish measure, to be brought into yards English, first take the $\frac{1}{2}$ of the giuen number, as appeareth in the first example towards your left hand. Then take the $\frac{1}{3}$ of that product, or the $\frac{1}{4}$ of the giuen number, and adde those 2 products together, they shall bee yards English; as by the Example you may perceiue,

The

*The second example toward your right hand is yet briefer then the first, whose worke is this; Take the* $\frac{1}{4}$ *of the deliuered number, and that product subtract out of the giuen number, and the rest sheweth your desire. Of these two wayes vse which you thinke best.*

*The proofe.*

In 648 yards of London,
How may Ells of Antwerpe?

648
216

maketh 864 —Ells of Antwerpe.

15 Rule. *ITem for the vnderstanding of this worke, first take the* $\frac{1}{3}$ *part of the yards of* London; *which found, adde that* $\frac{1}{3}$ *part and the yards together, as appeareth by the practise, and the product sheweth the Ells of* Antwerpe.

Item, in 320 yards of London,
How many Ells of Antwerpe?
maketh $426\frac{2}{3}$ Ells.

| | 320 yards. | | Proofe. |
|---|---|---|---|
| $\frac{1}{3}$ | $106\frac{2}{3}$ | | $426\frac{2}{3}$ Ells. |
| | $426\frac{2}{3}$ Ells | $\frac{1}{3}$ | $106\frac{2}{3}$ |
| | | | 320 yards. |

Other Reductions.

16 Rule. *ITem, you shall vnderstand, that forasmuch as sixe braces of Millan make fiue Ells of Antwerpe, whereupon according to the* Rules of Practise, *you may reduce the one into the other, by the like reasons aforesaid, in taking the* $\frac{1}{6}$ *part, and the subtra-*

*subtract the same, to make Ells of Antwerpe. And againe by the contrary, taking the $\frac{1}{5}$ part with adding the giuen number, to turne the Ells to Braces, as for example.*

In 876 Braces, how many Ells of Antwerp?

| | |
|---|---|
| 876 | The contrary. |
| 146 | 730 Ells Flemish. |
| Ells 730 Antwerpe | 146 Braces. |
| | 876 Braces. |

Ells 730 Antwerpe.
182 $\frac{1}{2}$.

Yards 547 $\frac{1}{2}$ English.

Thus appeareth, that 876 Braces by Practise, make 730 Ells Flemish, which Ells Flemish reduce into English yards.

So againe vpon the same first question of Braces, I would know how many yards English they make.

After the rate that 100 Braces are worth 62 $\frac{1}{2}$ yards.
876 Braces.
438
109 $\frac{1}{2}$.

I answer, 547 $\frac{1}{2}$ yards.

ITem, to the vnderstanding of this work, and such like, first take the $\frac{1}{2}$ of the giuen Braces, and after take the $\frac{1}{4}$ of that halfe, or the $\frac{1}{8}$ of the giuen number, and adde them together, and the products are also yards English. 17 Rule.

Item.

*Item, three Ells of Rochell make 5 Ells at Lisbone. So likewise three Ells at Lyons make 5 Ells at Antwerpe.*

*To worke these and such like, double the Ells of Lyons, and the Ells of Rochel, and from their products subtract the $\frac{1}{6}$, and the rest shall be the Ells of Antwerpe, or the Ells of Lisbone.*

*Example.*

In 63 Ells of Lyons how many Elles of Antwerpe?

63
63
126
$\frac{1}{6}$) 21
Anſ. 105 Ells Ant.

In 100 Ells of Rochell, how many Ells of Lisbone?

100
200
$\frac{1}{6}$) $33\frac{1}{3}$
Anſ. $166\frac{1}{3}$ ells of Lisb.

12 Rule. Touching the proofe or return of these and such like queſtions, for a general rule, you shall first take the $\frac{1}{5}$ of the giuen number and adde that $\frac{1}{5}$ and the giuen number together, and the $\frac{1}{3}$ of that product shall be your desire.

*Example.*

In 105 Ells of Antwerpe, how many Ells of Lyons?

105
$\frac{1}{5}$) 21
$\frac{1}{3}$) 126
An. 63 Ells of Lyons.

In $166\frac{2}{3}$ Ells of Lisbone, how many Ells of Rochell?

$166\frac{2}{3}$
$\frac{1}{5}$ $33\frac{1}{3}$
$\frac{1}{3}$) 200
An. 100 of Roch.

The

# The third Chapter teacheth of the order and worke of the Rule of 3 in broken numbers after the Trade of Merchants, digreſſing ſomething from M. *Records*, which is comprehended in three *Rules*.



*Now that I haue ſomewhat intreated of the Rule of Practiſe, I will giue a few inſtructions, after my ſimple order, for the working of the Rule of three in broken numbers, wherein I ſhall need to ſay the leſſe, becauſe I hope the ſtudious learner, that hath trauelled any thing in the* Grounds of Arts, *is not vnfurniſhed of knowledge capable to vnderſtand me.*

But before I deliuer any inſtructions for broken numbers, I will propone a queſtion which ſhall be wrought three ſundrie wayes, thereby to ſhew, as it were, three degrees of compariſon: how farre the Rule of three in broken, for more ſpeed of worke, differeth from the whole, which I rather ſet downe for a view, that the ſtudious herein may be more deſirous to attaine broken, leauing any more to diſcourſe in dialogue forme, but onely to giue inſtructions where need is: and in the reſt to put forth the queſtions with their anſwers.

My

*My first queſtion is this.*

The firſt way. If one yard coſt 6 ſ. 8 d. what are 789 worth at that rate?

1 —— 6 ſ —— 8 d —— 789

12 80

80 63120 d

Here the product of the ſumme are pence, according to the nature of the middle number

x x

x 3 7 0 x

6 3 x x 0 (5 x 6 0 (263

x x x x x x x x 0

x x x

I anſwer —— 263 li.

The ſecond way. 1 —— 6 ⅔ ſ —— 789

3 20 20

15780 ſ

Here the product of the ſumme are ſ. according to the nature of the middle number.

x

x 5 7 8 0 (5 x 6 0

3 3 3 3 x x x 0 (263 li

The third way. li.

1 —— ⅓ —— 789

3 1 1

789

Here

Here the product is pounds, according to the title of the second number.

x

789 (263

888

I answer. 263 li.

Now that you haue seene the three former vertues of the Rule of three, whose products haue first brought forth d. next s. and lastly li. I will deliuer three notes in order following: and with them a dozen questions that shall shew the work of the Rule of three In broken numbers or Fractions.

1 The first foure shall be sundry questions of a fraction comming in the second place. Note these three rules

2 The second foure shall be of two fractions coming in the second or third place.

3 The third foure of Fractions in all three places.

*Notes vpon the first Rule for a fraction coming in the second place.*

*My first question is this.*

*If one yard cost me* 3 s. 4 d. *what are* 756 *worth at that price?* 1 Rule.

In setting downe the question to performe the worke, I turne foure pence into the part of a shilling, which is $\frac{1}{3}$ and then the question standeth thus: The first variety.

1 — $3\frac{1}{3}$ — 756.

To

To the ready working of this Queſtion, and all ſuch other like, my firſt note is this, which take for a generall rule: that when any one Fraction ſhall come, either in the ſecond or third place, that the Denominator of that fraction or fractions, muſt alwayes be brought vnto the Number, or Numerator of the firſt place: and thereby multiply the one into the other.

A generall rule.

And this benefit is alwayes gotten by the vertue of bringing the Denominator of the ſecond Numbers Fractions vnto the firſt place: For the Fraction in the middle number is now releaſed: and the product that commeth of the multiplication, is of the nature and like Denomination of the whole Number in the ſecond place which here are ſhillings.

Note this.

Whereupon now to worke the queſtion, I bring 3, the Denominator of the Fraction in the ſecond place, vnto my firſt number 1, with a line ſet vnder thus $\frac{1}{3}$; and the 3 vnder it thus $\frac{1}{3}$: ſaying, once 3, is 3 my Diuiſor: that done, reduce $3\frac{1}{3}$ ſaying, 3 times 3 is 9, and the other 1 ouer 3 make 10: my ſecond number in the rule of three, by which 10 I do multiply my laſt number 756, as appeareth by the worke thereof, and it yeeldeth 7560 ſhillings my Diuidend.

Then diuiding 7560 by 3 my Diuiſor, it yeeldeth in quotient 2520 pounds, which maketh 126 pounds, as appeareth here moſt plainly, both by the example and the worke:

At

At 3 ſ. 4 d the yard, what 756 yards?

1 —— 3 1/3 —— 756
3 10 10
75901

x | x
75602x2x0 | (126.
3333xxxx0

Ianſwer 126 li.

*Yet otherwiſe vpon the ſame queſtion, altering the price now into the proportion it beareth to a pound, for the 3 ſ 4 d is 1/3 part of a pound: which example firſt ſtandeth thus, as appeareth on the left hand, and afterwards wrought as appeareth on the right hand.*

1 —— 1/3 —— 756
1 1
756 pounds.

1 —— 1/6 —— 756 6

The ſecond variety.

As ſoone as *I* haue carried 6 the denominator of my middle number vnto my firſt place, as before hath beene taught, I pull down one the numerator of 6, with a line vnder 6 thus, 6/1, and that one in cuſtome I pull downe in ſight, being the figure that I will multiply my third or laſt number by, according to the tenor of the rule of three. And becauſe one can neither multiply nor yet diuide (though here it is ſet downe in forme of multiplication, the rather for your vnderſtanding) the product of the multiplication according to the decla-

ration of this my first Rule or note, is conuerted into the title of my second number, which here are pounds. Now followeth the diuision performed in my Diuisor 6, to make an end of that question.

x3
756 (126. *which maketh* 126 li. *as before.*
666

*And thus much for the variety in working that question.*

And now followeth another.

## My second question.

If one yard of Cotton cost 8 ¼ d. what 859?

| 1 | 8 ¼ | 859 |
|---|---|---|
| 4 | 33 | 33 |
| | 2577 | |
| | 2577 | |
| | 28347 | |

x
x|3 x x x|1 li. s d
x 83447 (70886 (5 90 (29-10-6 ¾
4444 x x x x x 0

*This question was also wrought like the first, and bringeth forth* 29 li-10 s-6 ¼ d. *the price of* 859 *yards.*

My

## My third Queſtion.

If 7 pounds of any thing coſt 3 li—10 ſ. what comes 987 pounds to?

li.

7 —— 3 1/2 —— 987

2 7 7

14 6909

00

x4x

x84|7

6909(493 7/14|1/2

x444

xx

I anſwer, 493 li—10 ſ.

## Notes vpon my ſecond Rule for two Fractions comming in the ſecond and third place.

## My firſt queſtion is this.

IF one Ell coſt 13 ſ—4 d. what halfe a quarter or 1/8 of an Ell?

Anſwer. *Firſt bring* 13 ſ—4 d. *into the parts of a pound, which is* 2/3, *and then will the queſtion ſtand thus:*

1—2/3 li—1/8

ITem, for the performance of this worke, do as before was taught in the firſt Rule: firſt bring 3 *the* denominator *of the ſecond* fracti-

*en* vnto your *first number* 1. setting a line vnder it thus: $\frac{1}{}$ Saying once 3 is 3, that done, bring 8 the *denominator* of the *third fraction*, setting it vnder 3, and multiply them together, saying, 3 times 8 maketh 24, which 24 is your *diuisor*. (Now haue you done with the *denominator* 8.) Therefore you shall put a line vnder thus, $\frac{3}{}$. And the like line also vnder 8, setting or pulling downe vnder them their owne *numerators*, that is 2 vnder 3, and also 1 vnder 8, as appeareth in the example, which *numerators* for a generall rule euermore to be pulled down of custome in sight, to multiply the one by the other, according to the tenor of the *Rule of three*. Then *I* multiply the one by the other, saying, once 2 is two, which signifieth 2 li. being of the nature and like denomination of the middle number, which 2 li. is to be reduced into shillings, otherwise it cannot be diuided by my first number 24.

Then diuiding 40 by 24, the quotient bringeth forth $1\frac{2}{3}$. So much is $\frac{2}{3}$ of an Ell worth after that rate. Otherwise although 2 pound could not be diuided by 24, yet it might haue been abreuiated to $\frac{1}{12}$ of a pound: which is worth 1 s. 8 d. as before.

li.

li.

$$1 \text{———} \tfrac{2}{3} \text{———} \tfrac{3}{8} \quad (1$$

3 2 1 2 (6

8 20 4 8 (1 $\frac{2}{3}$ (

24 40 24

*Second queſtion.*

*IF one pound of any weight coſt* 13 *ſhillings* 4 *pence, what are* $\frac{7}{8}$ *of the pound worth after that rate?*

*Anſwer.* Reduce the 13 ſhillings 4 pence into the parts of a pound: which is $\frac{2}{3}$, and then will the queſtion ſtand thus.

li.

$$1 \text{———} \tfrac{2}{3} \text{———} \tfrac{7}{8}$$

*ITem for the vnderſtanding of this, if you marke well the laſt example, this and the reſt lieth open, and need ſmall inſtruction. For as you did laſt, ſo againe, bring the* denominator *of the ſecond and third* Fraction *vnto the firſt figure* 1, *multiplying the one into the other, which maketh alſo* 24, *your* Diuiſor.

*Then making a line vnder* 3, *thus,* $\underline{3}$, *and a line vnder* 8, *thus* $\underline{8}$, *and pulling downe their* Numerators *vnder each figure, that is* 2 *vnder* 3 *and* 7 *vnder* 8, *which as I ſaid before for a generall rule I pull downe of cuſtome in ſight, to bee the two numbers that of duty ought to bee multi-*

Note.

plyed together, which done, I bring 2, being the leſſer figure vnder 7, multiplying them together, it maketh 14, which are of the nature of the middle number: that is to wit, pounds: which 14 cannot aptly bee diuided among 24, therefore are reduced into *ſhillings*, as is plainly to be ſeene in the example: then 280 *ſhillings* parted among 24, yeeldeth for his *quotient* 11 ſ 8 d. your deſire, and the juſt price of $\frac{7}{8}$ of an *Ell*. Otherwiſe 14, though it could not be diuided by 24, might by *mediation* or *diuiſion* in broken *numbers* haue been diuided or abbreuiated to $\frac{7}{12}$, which in effect being reduced to his knowne parts, maketh 11 ſ. 8 d. as before. But my good will and meaning is to aid yong beginners: therefore haue I reduced the 14 *pound* into *ſhillings*, which is the eaſier way.

*Now followeth the Example.*

| | | | |
|---|---|---|---|
| 1 | 2 | 7 | li |
| 3 | 3 | 8 | a |
| 8 | 2 | 7 | 4 (6 |
| 24 | | 2 | a 8 0 (11 $\frac{1}{3}$ ſ. |
| | | 14 | a 4 4 |
| | | 20 | a |

280 ſ Ianſwer, 11 $\frac{1}{3}$ ſ.

The

*The third Example.*

If one yard coſt mee 2 ſ. 6 d. what 345 ¼ yards?

*Anſwer.* Firſt put 6 d. into the parts of a ſhilling, and then the queſtion ſtandeth thus.

I——2 ½——345 ¼

Item, to the ready vnderſtanding of this, and all ſuch like, according as before hath been declared, bring the *Denominators* of the ſecond and third *Fractions* vnto the firſt place, multiplying them the one into the other, all which make 8 for the common *Diuiſor*. Then next reduce your ſecond number, ſaying, two times 2 is 4, and 1 is 5; as was taught in the example aforeſaid. Laſtly, reduce your third number 345 ¼ all into fourths, and they make 1381, which 1381 is to be multiplyed by 5, according to the tenor of the *Rule of three*: which done, maketh 6905 ſ. and diuided by 8, your Diuiſor yeeldeth in Quotient 863 ⅛ ſ. which maketh in pounds 43 li. 3 ſ. 1 ½: and ſo much are the 345 ¼ yards worth at that price.

*The ſame queſtion wrought againe by 2 ſhillings 6 pence, is now conuerted into the parts of a pound, and ſtandeth thus.*

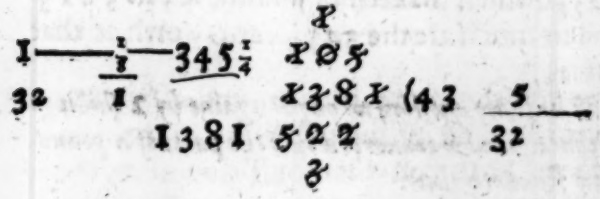
I——½——345 ¼

Item, after I haue brought here my ſecond and third *denominator* vnto my firſt place, and found 32 to be my *Diuiſor*; hauing thus finiſhed

ſhed my firſt place with all things vnto him belonging (which is meant of bringing and multiplying the Denominators of the ſecond and third fractions into him) I then go in hand to ſee what is to do in my ſecond place, where preſently of cuſtome *I* pull downe my Numerator 1 vnder 8, being the figure in ſight that ſhall multiply my third number.

Then laſtly I reduce $345\frac{1}{4}$ all into fourths, as afore was practiſed, which maketh 1381, the which 1381 I am to multiply by 1 my ſecond number, they are nothing increaſed, but by the *Metamorphoſis* of my worke they are now 1381 pound, being of the nature of the middle number as I haue often ſhewed you, which diuided by 32 my diuiſor, yeeldeth 43 pound and $\frac{5}{32}$, which $\frac{1}{32}$ of a pound reduced into knowne numbers, make 3 ſhillings $1\frac{1}{2}$ d, as before.

*Example.*




NOw follow foure other queſtions, which are in all three places broken numbers, or whole and brok.n together.

*Item*, firſt for the finding out of your *Di-*

*uiſor*,

*wiſer*, you ſhall take this for a moſt certaine and generall rule: That you muſt multiplie the *numerator* of the firſt *number* in the queſtion, by the *Denominator* of the ſecond: And that *Product* againe, by the *Denominator* of the third: And the totall thereof ſhall bee your *Diuiſor*.

Secondly, for a generall rule to finde out your *Diuidend*, *Multiply* the *Denominator* of the firſt number by the *Numerator* of the ſecond, and the whole thereof by the *Numerator* of the third. And the totall thereof ſhall euermore be your *Diuidend*.

*Now for an example, I propone this queſtion, thereby to make my meaning the more plaine, and to ſhew you, as I haue done in the reſt, the manner and order of the worke.*

*If* $\frac{2}{3}$ *of any weight or meaſure coſt* $\frac{1}{6}$ *of a pound, or* 20 *ſ. what are* $\frac{3}{8}$ *of the like weight or meaſure worth after that rate?*

Example.

$\frac{2}{3}$ —— $\frac{1}{6}$ —— $\frac{3}{8}$.

ITem for the more plainer vnderſtanding hereof, and all other the like, in broken numbers: Firſt you ſhall pull downe 2, the *Numerator* of the firſt *Number* or Fraction, with a line vnder thus, $3\ \frac{1}{3}$: that done, according as you haue learned before, bring 6, the *Denominator* of the ſecond *Fraction*, and ſet it vnder 2, multiplying the one into the other,

other, which maketh 12. Then lastly bring 8, the *Denominator* of the third *Fraction*, and set it vnder 12, multiplying that 12 by 8, which amounteth to 96, or else for more briefe, multiply 6 by 8, saying, 6 times 8 makes 48, which 48 set vnder 2, and multiply the one into the other, it maketh 96, as before. And this 96 is the first *number* in the Rule of three. That shall alwayes for a most generall rule be your *Diuisor*.

Secondly, to worke for your *Dividend*, you shall (as hath beene sufficiently declared before) pull downe 5, the *Numerator* of your second *fraction*, and set it vnder 6, with a line vnder thus, $\frac{5}{6}$.

That done (as you know) you are to pull downe 3, the *Numerator* of the third *Fraction*, and set it vnder 8, with a line vnder it thus, $\frac{3}{8}$ multiplying the one into the other, according to the tenour of the Rule of three; which maketh 15. Then according to my note, forget not to bring the *Denominator* of the first *Fraction* which is 3, vnder 15, and multiply them together, which maketh 45, which 45 is your *Dividend*, and are of the nature or *Denomination* of the Middle *number*, as I haue taught you before: And therefore are 45 l. which aptly cannot be diuided by 96. Therefore you shall reduce the 45 li. into s. as you see performed in the Example, which amounteth to 900 s. which diuided by 96 your diuisor,

uiſor, it yeeldeth 9 ſ. and $\frac{16}{96}$ of a ſhilling, which in leſſer termes is $\frac{1}{6}$: which $\frac{1}{6}$ in money maketh 4 $\frac{1}{2}$ d: and ſo much will the aforeſaid $\frac{3}{8}$ coſt, as by the worke following ſhall appeare.

*The Example.*

| 2 | 5 | 3 | |
|---|---|---|---|
| 3 | 6 | 8 | |
| 2 | 5 | 3 | |
| 6 | | 5 | 13 |
| | | 15 | 9/6 |
| 12 | | 3 | 9 0 0 0 (9 $\frac{16}{96}$ ſ. |
| 8 | | 45 | 96 |
| 96 | | 20 | |
| | | 900 | |

Otherwiſe though 45 could not be diuided by 96, yet by Diuiſion in broken numbers it might haue beene abbreuiated to $\frac{15}{32}$ of a li. which reduced into knowne parts, will make 9 ſ. 4 $\frac{1}{4}$ d. as before.

*Now my ſecond example ſhall be the proofe of this queſtion.*

*If $\frac{3}{8}$ yards coſt $\frac{15}{32}$ of a pound or 20 ſhillings, what ſhall $\frac{3}{8}$ coſt?*

*Anſwer.* Worke as was taught you before, and you ſhall haue your deſire.

Here

$\frac{3}{4}$ — $\frac{15}{32}$ — $\frac{2}{3}$

3 15 2

32 2

96 30

3 8•

288 240

Here as appeareth by the worke, the multiplication being ended, 240 is to be diuided by 288, which to some perchance may seeme hard, yet notwithstanding is the worke good. Therefore abreuiate 240 by 288, as you see here is practised: and the end of your abreuiation shall come to $\frac{5}{6}$ your desire, $\frac{240|30|5}{288|36|6}$.

*Otherwise.* 240|120|60|30|5
288|144|72|36|6

*Otherwise.* 240|40|5
288|48|6

## The third Question.

*If $\frac{3}{4}$ Ells cost* 13 s-4 d. *what* 156 $\frac{5}{8}$ *Ells?*

*Answer.* To worke this question the shortest way: reduce 13 s-4 d. into the parts of a pound, which is $\frac{2}{3}$.

Then as you did afore, after you haue set downe the question, the numerator of the first fraction 3 is pulled downe vnder 4, and *Denominators* of the other, 2 *Fractions* multiplied

plied into him, which maketh 18, your *Diuisor.*

Then the *Numerators* of the second *Fraction* is pulled downe, vnder 3 of custome now in sight, ready to *multiply* my third number by which is performed as soone as the last numbers $156\frac{1}{2}$ is reduced into halfes.

Then lastly, I multiply that product by 4, the *Denominator* of the *Fraction*: it yeeldeth 1504, which I diuide by 18, and my quotient is 139 li and $\frac{1}{3}$ of a pound remaining, which is worth 2 s $-2\frac{2}{3}$ d. And so much will $156\frac{1}{2}$ ells cost, as by the worke following doth appeare.

| | | | | |
|---|---|---|---|---|
| 3 | 2 | $156\frac{1}{2}$ | x | |
| 4 | 3 | 313 | 47 | |
| 3 | 2 | 2 | x76\|2 | li. |
| 6 | | 626 | 250 4 | ($139\frac{1}{3}$ |
| 18 | | 4 | x88 8 | |
| | | 2504 | xx | |

## The fourth question.

*If* $2\frac{1}{2}$ *Ells cost* $1\frac{2}{3}$ pounds, *What cometh* $29\frac{1}{4}$ *Ells to?*

*Item*, to the workmanship of this question, first reduce your second *Number* in saying, three times 1 is 3, and 2 is 5, Then bring the *multiplication* of the *Denominators* of the second and third *Fractions* which maketh 12: and *multiply* that 2 by 5 your first *numerator*, and

and it maketh 60, which is your *diuisor*.

Then the *reduction* of the second number, which is 5, *multiplied* by 117 the product of the last *numbers* reduction, make 585, which 585 yet resteth to be *multiplied* by 2 the *denominator* of the Fraction in the first place, yeeldeth 1170, which diuided by your *Diuisor*, 60, yeeldeth 19 pound, 10 ſ. as appeareth by the worke thereof.

Thus hauing now touched the 12 questions whereof I first pretended, which with diligence and oft practise, *I* trust are sufficient to aide the desirous vnto the working of any broken numbers, I will now intreate of diuers necessary Rules incident vnto trafficke, as hereafter followeth.

## The 4 Chapter treateth of Losse and gaine in the Trade of Merchandise.

IF one yard cost 6 ſ—8 d. and the same is sold againe for 8 ſ—6 d. the question is, what is gained in 100 pounds laying out on such commodities?

*Answer.* The Rule of three direct, applied two manner of wayes to do the same: the one is to say, If $6\frac{1}{3}$ giue $8\frac{1}{3}$, what giueth 100? *Multiply* and diuide, and looke what your quotient bringeth foorth aboue your laying out, is the neate gaines, and solution

to

to your queſtion: If you follow the worke, your ſolution will bring forth 127 li.—10 ſ. which is 27 li. 10 ſ. more then your principall, and ſo much is gained in the 100 pounds laying out.

Item, to work it the other way, which I take the neareſt, ſeeke the difference betwixt the iuſt price and the other price, which is one ſhilling 10 pence; then ſay by the rule of three: If 6 $\frac{1}{3}$ ſ. gaine 1 $\frac{1}{6}$ ſ. what ſhall 100 li. gaine? *Multiply* and diuide, and you ſhall finde 27 li. 10 ſ. and ſo much is gained in 100 li. laying out.

You may vſe which of theſe two wayes you thinke good.

## The proofe.

If a yard of Cloth be deliuered for 8 ſ. 6 d. whereupon was gained after the rate of 27 li. 10 ſ. in 100 pounds laying out: The queſtion is, what the yard coſt at the firſt hand?

*Anſwer.* Put your gaine 27 pounds 10 ſ. to 100 pounds, all maketh 127 li—10 ſ. Then ſay, If 127 li. 10 ſ. giue but 100 pound, what giueth 8 $\frac{1}{2}$ ſ? Worke and you ſhall finde 6 ſ—8 d. the true ſolution to your queſtion.

### Yet another Example, or proofe vpon the firſt queſtion.

If one yard coſt 6 ſ 8 d. the queſtion is, what

what price the same is to be sold againe, for to gaine 27 li. 10 s. in 100 pounds laying out?

Answer. *Say by the Rule of three, if* 100 li. *gaine* 127 li–10 s. *what gineth* 6 $\frac{2}{3}$ s? *Multiply and deuide, and you shall finde* 8 s. 6 d. *your true solution.*

If one Ell cost 7 s. 8 d. and be sold againe for 8 s. 6 d. *The question is,* What is gained in 20 pounds laying out in such commodities?

Answer. *Seeke the difference betwixt the iust price, and the other price which is* 10 *pence, and then apply the* Rule of three, *as before is taught, saying, If* 7 $\frac{2}{3}$ s *giue* $\frac{5}{6}$ *shillings, what gineth* 20 li? *Multiply and deuide, and you shall finde* 2 li 3 $\frac{11}{13}$ s. *and so much is gained in* 20 pound *laying out.*

The proofe also by an example of losse.

A *Merchant hath bought Holland cloth at* 8 s. 6 d. *the* Ell, *which proueth not to his expectation, whereupon he is content to lose* 2 li. 3 $\frac{11}{13}$ s. *in* 20 *pounds laying out. The question is, what price ought to be made of the Cloth, abating this losse?*

*Answer.* Do as before in Gaines hath beene taught, putting 2 li. 3 $\frac{11}{13}$ s. to your 20 pound, all together maketh 22 li–3 $\frac{11}{13}$. Then say by the Rule of three, If 22 li–3 $\frac{11}{13}$ s. giue but 20 li. what shall come of 8 $\frac{1}{2}$ s? work, and you shall finde 7 s–8 d. the iust price that the Ell ought

to

to be sold for after the rate of this losse.

Thus it appeareth euidently, as in company the *Rule* is appliable as well to gaine as losse.

*If* 20 ¼ *yards cost* 26 li ½ 10 ſ, *how shall I sell the same againe to gaine* ⅓ *of the principall, or to make of* 3.4, *which is all one.*

*Answer.* By the *Rule of three*, if 3 doe giue 4, what will 36 ½ giue? Multiply and diuide, and you shall finde 48 ⅔ li. Then say againe, if 20 ¼ yards doe giue 48 ⅔ pounds, as well principall as gaine, what will one yard bee worth at that price? Multiply and diuide, and you shall finde 2 li. 8 $\frac{16}{243}$ ſ.

*If one Elle of Cloth cost mee* 8 ſ, 8 d, *and afterwards I sell* 10 ½ *Elles thereof for* 5 li, 13 ſ. 4, d, *I would know whether I winne or lose: and how much vpon the* 100 *pounds of money.*

*Answer.* See first at 8 ſ. 8 d, the Elle, what 10 ½ Elles comes to, and you shall finde 4 li, 11 ſ, and I sold the same for 5 li. 13 ſ. 4 d, so that I did gaine vpon the 10 ½ *Elles* 22 shillings 4 pence. Then if you would know how much is gained in 100 pounds, I say by the *Rule of three*, If 4 li, 11 ſ did gaine 22 ſ 4 d, what will 100 pounds gaine? Multiply and diuide, and you shall finde 24 pound-10 ſ -10 d $\frac{10}{91}$ and so much is gained in the 100 pound of money.

*If* 12 ½ *yards cost mee* 11 *pound fiue shil-*

*lings, and I sell the yard againe for 16 shillings, the question is, whether I doe win or lose, and how much in or vpon the pound of money?*

*Answer.* Look what the 12 $\frac{1}{2}$ yards come to at 16 s the yard, and you shall finde 10 pound. But they cost 11 pound 5 shillings. So there is lost vpon the whole 1 li, 5 s. Then to know how much is lost in the pound, say by the rule of 3, if 11 $\frac{1}{2}$ pound doe lose 1 $\frac{1}{2}$ pound, what will 1 pound lose? Multiply and diuide, and you shall finde 2 s 2 d $\frac{2}{23}$, and so much is lost in the pound of money.

*If I sell the 100 weight of any commodity for 4 pound, whereupon I doe lose after 10 pound in the 100 pound, I demand how much I shall lose or gaine in the 100 li? if in case I had sold the same for 4 pound 10 shillings.*

*Answer.* Say, if 90 pound yeeld 100, how much will 4 giue? multiply and diuide, and you shall finde 4 $\frac{4}{9}$. Then say againe, if 4 $\frac{4}{9}$ giue me 4 $\frac{1}{2}$ what will 100 come to? Multiply and diuide, and you shall finde 101 pound $\frac{1}{2}$ which is more then 100 pound by 1 pound 5 shillings: & so much is gained in the 100 pound.

*A Merchant hath sold Currans for the summe of 430 pound, and hee hath gained therein after 10 pound in the 100 pound. The question it to know how much he gained in all.*

*Answer.* Say by the rule of three. If 100 pound doe gaine 10 pound, what will 430 pound gaine? Multiply and diuide, and you shall finde 43, and so much hath he gained in all.

If

*If one yard be worth* 28 ½ *s. for how mu*
10 *yards be sold to gaine after* 8 li. 6 *s* 8 *d*
100 *pound.*

*Answer.* First adde 8 li—6 *s*–8 *d.* to
Then say, if 100 li. do giue 108 ⅓ for pri
pall and gaine, what will 28 ⅓ *s* princi
yeeld? Multiply and diuide, and you shall
20 ⅞ *s.* Then say againe by the Rule of th
if 1 yard do giue 30 ⅞ *s* (which is as well t
principall as the gaine) what shall 10 yards
giue? Multiply and diuide, and you shall finde
15 li. 8 *s* 9 *d.* And for the same price shall the
10 yards be sold, for to gaine after the rate of
8 li–6 *s*–8 *d.* vpon the 100.

## A branch or proose out of this Question.

*A Merchant hath sold clothes for* 15 li–8 *s*
—9 *d. and he hath gained in the whole, the summe*
*of* 1 li.—3 *s*—9 *d. The question is, to know how*
*much he hath gained in the* 100 *pound?*

*Answer.* To know this, first rebate the
gaines from the price, and there will remaine
14 li. 5 *s* 0 *d.* Then say by the rule of three di-
rect, if 14 li. ¼ giue me 1 li. 3 ¾ *s.* what will 100
li. giue? Multiply and diuide, and you shall
finde 8 li. 6 *s*–8 *d.* the effect desired, the proose
is apparant in the question before.

## et another Branch or Proofe of the firſt Queſtion.

*If* 10 *yards be delinered for* 15 li, 8 ſ, 9 d. *reupon was gained after the rate of* 8 li, 6 ſ. *vpon the* 100 *pound, the queſtion is, what the did coſt at the firſt hand.*

*Anſwer.* Firſt, ſay by the Rule of three, if 10 with principall and gaine yeeld 15 li. 8 ¾ ſ. what ſhall 1 yeeld? Multiply and diuide and you ſhall finde 30 ⅞ ſ. Then ſay againe by the rule of three, if 108 ⅓ principall and gaine giue but 100, what ſhall 30 ⅞ ſ. of principall and gaine yeeld? Worke, and you ſhall find 21 ⅓ ſ. And ſo much did the yard coſt at the firſt Penny.

*If one yard coſt* 36 ſ. *how much ſhall* 12 *yards be ſold for to gaine after the rate of* 10 li. *in the* 100?

*Anſwer.* Firſt, ſay, If 100 giue 110 pound principall and gaine, what will 36 ſ. giue? Multiply and diuide, and you ſhall finde 39 ⅗ ſ. Then ſay againe by the Rule of three, If one yard of principall & gaine yeeld 39 ⅗ ſhillings, what ſhall 12 yards gaine? Multiply and diuide, and you ſhall finde 23 li,-15 ⅕ s, which ⅕ ſ. in knowne number, is 2 ⅖ d. And for the ſame price ſhall the 12 yards be ſold, to gaine after the rate of 10 in the 100.

### The prooſe.

*If* 12 *yards be ſold for* 23 li.-15-2 ⅖ d, *where-*

*upon*

*upon is gained after* 10 li. *in the* 100. *The question is, what the yard cost at the first penny?*

*Answer.* First say, if 12 giue 23 li. $15\frac{2}{3}$ *s*, what one yard? Multiply and diuide, and you shall finde $39\frac{1}{3}$ *s*. Then say againe by the rule of 3, if 110 pounds giue but 100, what shall $39\frac{1}{3}$ *s* giue? Worke and you shall finde 36 *s*. the iust price of the yard at the first hand.

*Item, When one Merchant selleth wares to another, and he giueth to the buyer* 1 li 6 *s*, 8 d, *vpon the score, or* 20 li: *The question is, How much shall the buyer gaine vpon the* 100 *pound after that rate.*

*Answer.* First adde 1 li-6 *s*-8 d, vnto 20 li, and they are $21\frac{1}{3}$. Then say, if 20 pound giue $21\frac{1}{3}$, what shall 100 giue? Multiply and diuide, and you shall finde $106\frac{2}{3}$. So the buyer getteth after the rate of $6\frac{2}{3}$ li, vpon the 100 pound.

Gentle Reader, other necessary questions appertaining to Losse and Gaine, you shall haue in the eight Chapter of this Treatise.

# The fifth Chapter entreateth of Loſſe and Gaine vpon time, wrought by *the double rule of three, or by the Rule compoſed*: which is contained 4 ſpeciall ſelected branches or queſtions of diuers formes, *each one of them ſpringing from the firſt* queſtion, and each one of them alſo, being a proofe to other, &c.

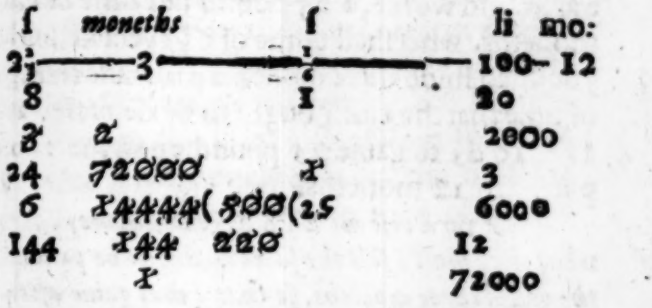
*IF one yard coſt mee* 2 ſ—8 d. *ready money, and after I ſell the ſame againe for* 2 ſ—10 d. *to be paid for it at the end of* 3 *moneths: the queſtion is, what I gaine vpon the* 100 li. in 12 *moneths?*

*Anſwer.* Firſt ſay, if $2\frac{2}{3}$ gaine $\frac{1}{6}$, what ſhall 100 li gaine? Multiply and diuide, and you ſhall finde $6\frac{1}{4}$ li. Then ſay againe, by the Rule of three, if three moneths gaine $6\frac{1}{4}$ pound, what ſhall 12 moneths gaine? Worke, and you ſhall finde 25 li. and ſo much ſhall I gaine in 12 moneths after that rate.

Item, you may alſo worke it all at one working by the firſt part of the rule of 3 compoſed, ſaying, if $2\frac{2}{3}$ d in three moneths do gaine $\frac{1}{6}$ of a ſhilling (which is 2 d.) what will 100 li. gaine

in

in 12 moneths: which for thy further encouragement the worke of this one example I haue here put downe, to verifie that I affirme in the first part of this *Ground of Arts*, that this rule and so all others, more reioiceth in *Broken* then in *Whole*.




Where the multiplication and the diuiſion being ended, maketh 25 li your deſire.

*If a yard be deliuered for 2 ſ—10 d, to be paid at 3 moneths, whereupon was gained after the rate of 25 li in the 100 for 12 moneths, the queſtion is now what the yard coſt at the firſt hand?*

*Anſwer.* Firſt ſay, if 12 moneths gaine 25 li, what ſhall three moneths gaine? Worke and you ſhall finde 6 ¼ li: Then ſay againe the ſecond time, if 106¼ li, giue but 100, what ſhall 2 ⅙ ſ giue? Worke, and you ſhall find 2 ſ 8 d, which is the iuſt price that the yard coſt at the firſt hand.

*If one yard of cloth coſt mee 2 ſ—8 d ready*

*money, for what terme shall I sell the same againe for 2 s. 10 d, so that I might gaine after the rate of 25 pound vpon the 100 pound in 12 moneths.*

*Answer.* First say, if $2\frac{2}{3}$ gaine $\frac{1}{8}$ what shall 100 pound gaine? Multiply and diuide, and you shal finde $6\frac{1}{4}$ pound. Then say againe for the second worke, if 25 pound be come of 12 moneths, what shall come of $6\frac{1}{4}$? Worke, and you shall finde three moneths, the iust terme of time that the cloth ought to be deliuered at 22 s. 10 d, to gaine 25 pound vpon the 100 pound in 12 moneths.

*If one yard cost me 2 s 8 d, ready money, for what price shall I sell the same againe to be paid at the end of three moneths, so that I may gaine after the rate of 25 pound in the 100 pound for 12 moneths.*

*Answer.* First say, if 12 gaine 25 li, what shall 3 moneths gaine? Multiply and diuide, and you shall finde $6\frac{1}{4}$ li. Then say for the second worke, if 100 li, giue 10 $6\frac{1}{4}$, what giueth $2\frac{2}{3}$ s? Worke and you shall finde 2 s. 10 d, and for that price must the yard bee sold to gaine after 25 pound in the 100 pound for twelue moneths.

Many other of these questions I might here haue deliuered, but for feare the Booke would rise to too thicke a volume, and so to make the price so much the dearer, whereby it might not bee so portable to my Countrymen as I wish it. But these 4 I haue of purpose framed in this order, hauing relation one to another,

assuring

assuring you that what question soeuer may be proposed within the compasse of this Rule you shall finde by one of these 4, to make a solution: And moreouer, diuers others are yet to be deliuered, where the Greditor giueth diuers dayes of payment, which can neuer bee wel wrought, nor yet vnderstood, vnlesse you can first finde by art the iust times that al those payments, how different soeuer they be, ought to be paid at once: whereupon first I thinke good here to giue some instructions into such a rule, for it is the onely aide for the finishing of such questions as hereafter shall follow;

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## The sixth Chapter intreateth of Rules of Payment, which is a right necessary Rule, and one or the chiefest hand-maides *that attendeth vpon buying and selling, &c.*

### Example.

*A Merchant doth owe a summe of money, whereof, the $\frac{1}{3}$ is to be paid at 6 moneths, and the $\frac{1}{3}$ at 8 moneths, & the rest at a yeere If hee would pay all at one payment, the question is, what time ought to bee giuen him.*

*Answer.* I haue omitted the quantity of the

*money, for what terme shall I sell the same againe for 2 ſ. 10 d, ſo that I might gaine after the rate of 25 pound vpon the 100 pound in 12 moneths.*

*Answer.* First say, if $2\frac{2}{3}$ gaine $\frac{1}{6}$ what shall 100 pound gaine? Multiply and diuide, and you shal finde $6\frac{1}{4}$ pound. Then say againe for the second worke, if 25 pound be come of 12 moneths, what shall come of $6\frac{1}{4}$? Worke, and you shall finde three moneths, the iuſt terme of time that the cloth ought to be deliuered at 22 ſ. 10 d, to gaine 25 pound vpon the 100 pound in 12 moneths.

*If one yard coſt me 2 ſ 8 d, ready money, for what price ſhall I ſell the ſame againe to be paid at the end of three moneths, ſo that I may gaine after the rate of 25 pound in the 100 pound for 12 moneths.*

*Answer.* First say, if 12 gaine 25 li, what shall 3 moneths gaine? Multiply and diuide, and you shall finde $6\frac{1}{4}$ li. Then say for the ſecond worke, if 100 li, giue 10 $6\frac{1}{4}$, what giueth $2\frac{2}{3}$ ſ? Worke and you shall finde 2 ſ. 10 d, and for that price muſt the yard bee ſold to gaine after 25 pound in the 100 pound for twelue moneths.

Many other of theſe queſtions I might here haue deliuered, but for feare the Booke would riſe to too thicke a volume, and ſo to make the price ſo much the dearer, whereby it might not bee ſo portable to my Country men as I wiſh it. But theſe 4 I haue of purpoſe framed in this order, hauing relation one to another,

aſſuring

assuring you that what question soeuer may be proposed within the compasse of this Rule you shall finde by one of these 4, to make a solution. And moreouer, diuers others are yet to be deliuered, where the Greditor giueth diuers dayes of payment, which can neuer bee wel wrought, nor yet vnderstood, vnlesse you can first finde by art the iust times that al those payments, how different soeuer they be, ought to be paid at once: whereupon first I thinke good here to giue some instructions into such a rule, for it is the onely aide for the finishing of such questions as hereafter shall follow;

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## The sixth Chapter intreateth of Rules of Payment, which is a right necessary Rule, and one or the chiefest hand-maides *that attendeth vpon buying and selling, &c.*

### Example.

*A Merchant doth owe a summe of money, whereof, the $\frac{1}{3}$ is to be paid at 6 moneths, and the $\frac{1}{2}$ at 8 moneths, & the rest at a yeere If hee would pay all at one payment, the question is, what time ought to bee giuen him.*

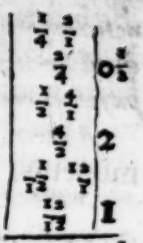
*Answer.* I haue omitted the quantity of the

the ſumme, for you ſhall vnderſtand, the Rule is appliable, and yeeldeth a true ſolution to what ſumme ſoeuer ſhall be propoſed: But now for order ſake in teaching, I doe imagine the ſumme to be 60 pounds, whereupon the manner of this worke is to multiply the proportionate part of the money by the time, as in company. Then 20 being the firſt payment, and the $\frac{1}{3}$ of 60, which $\frac{1}{3}$ multiplied in broken numbers by 6, his time of payment maketh $\frac{6}{3}$, which in whole numbers, as appeareth by the example in the operation, maketh two moneth: next 30 which is the $\frac{1}{2}$ multipled by his terme 8, yeelds 4 moneths, then the reſt which is 10 li, muſt needs be abreuiated into the proportion it beareth to 60, which is $\frac{1}{6}$ which $\frac{1}{6}$ multiplied by his time 12 moneths, produceth $\frac{12}{6}$ maketh two moneths. All which added together, as appeareth in the operation, maketh eight moneths, which is the iuſt time that all thoſe payments ought to be paid at once.

| | | |
|---|---|---|
| $\frac{1}{3}$ by $\frac{6}{1}$ $\frac{6}{3}$ | 2 | Mon: |
| $\frac{1}{2}$ by $\frac{8}{1}$ $\frac{8}{2}$ | 4 | Mon: |
| $\frac{1}{6}$ by $\frac{12}{1}$ $\frac{12}{6}$ | 2 | Mon: |
| | 8 | Mon: |

*A Merchant hath 800 li to pay, the $\frac{1}{6}$ thereof ready money, the $\frac{1}{4}$ at two moneths, the $\frac{1}{3}$ at foure moneths, and the reſt at a yeare. The queſtion is, if he would pay all at one payment, what time ought to be giuen him?*

*Anſwer:*



*Answer.* The ready money is neuer multiplied: then $\frac{1}{4}$ multiplied by two moneths as you did before, maketh $\frac{1}{2}$, then $\frac{1}{2}$ by 4 produceth 2 moneths, as appeareth here in the operation. But now for the rest of the money you cannot multiply it vntill you haue sought what proportion it beareth to 800 pounds. Therefore you must subtract the readie money, the $\frac{1}{4}$ and the $\frac{1}{2}$ out of the principall. The rest will be $66\frac{1}{3}$ li. which you must looke what part it beareth to the principall, which you shall finde to be $\frac{1}{12}$, the same you must also multiply by his time 12 moneths, and it yeeldeth 1 moneth, so all make $3\frac{1}{2}$ moneths, as appeareth in the operation.

*A Merchant is to pay* 1200 li. *in three termes, that is to wit,* 400 li. *at two weeks, and* 600 li. *at foure moneths: lastly,* 200 li. *at fiue moneths. The question is, in what time they ought to be paied at once?*

*Answer.* Proportionate the parts, and you shall finde that 400 is $\frac{1}{3}$ part, and for 600 you shall finde $\frac{1}{2}$, and likewise 200 is the $\frac{1}{6}$ part, which multiply by their times as before, and you shall haue $\frac{2}{3}$ weeks, more eight weeks, and lastly three $\frac{1}{1}$ weeks, which together maketh twelue weeks, or three moneths your desire.

*A Merchant is to pay* 600 *pound in three termes, whereof* 100 *pound is payed present, more* 300 *pound at twenty dayes, and the rest at fiue moneths,*

*neths, accounting thirty dayes to a moneth. The queſtion is, what time ought theſe payments to bee payed at once.*

*Anſwer.* Worke, and you ſhall finde two moneths.

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## The ſeuenth Chapter intreateth of buying and ſelling in the Trade of Merchandiſe, wherein is taken part readie Money, and diuers dayes of payment giuen for the reſt, & what is won or loſt in the 100 li, *forbearance for* 12 *moneths more or leſſe,* according to the quantity of money, or proportion of time, &c.

*A Merchant hath bought Sattens which coſt eight ſ the yard ready money. And he ſelleth the ſame againe to another man for ten ſ the yard, but he gineth two dayes for the payment, that is to ſay, three moneths for the one halfe, and fiue moneths for the other halfe. The queſtion is to know how much the ſeller doth gaine vpon the* 100 *pound in* 12 *moneths after that rate.*

*Anſwer.* Seeke firſt by the Rules of payment, at what time thoſe two payments ought to be payed at once, and you ſhall finde foure moneths, at which time the ſecond Merchant ought to haue paid the whole entire paiment:

And

And therefore ſay by the firſt part of the Rule of three compoſed: If 8 ſhillings in 4 moneths doe gaine 2 ſ, what will 100 li. gaine in 12 moneths? x

| ſ | m | ſ | li | m. |
|---|---|---|---|---|
| 8 | 4 | 2 | 100 | 12 |
| 4 | | | 20 | |
| 32 | | | 2000 | |
| | | | 2 | |
| | | | 4000 | |
| | | | 12 | |
| | | | 48000 | |

x 46 x ſ

48000 (x500 (75

322 220

3

Multiply and diuide, and you ſhall finde 75 pounds, as appeareth in the example, and ſo much doth the firſt Merchant gaine vpon 100 pounds in 12 moneths.

*A Merchant hath ſold fifty clothes, at 9 $\frac{1}{3}$ li. the peece, to be paid the one $\frac{1}{3}$ at foure moneths, the $\frac{1}{3}$ at fiue moneths, and the $\frac{1}{6}$ at 7 moneths, and the ſellers minde is to take no more but after 8 pounds in the 100 for 12 moneths. The queſtion is now what the firſt Merchant gaineth in the ſale of theſe clothes after that rate.*

*Anſwer.* Firſt looke what the 50 cloathes come to at that price, and you ſhall finde 475 pounds. Then ſecondly, according to your direction in the rules of payment, ſeeke at what time all the payments are to be performed at once. And you ſhall finde 4 $\frac{5}{6}$ moneths. Then thirdly ſay by the firſt part of the Rule of three compoſed, If 100 li. in 12 moneths gaine 8 li. what will 475 li. gaine in 4 $\frac{5}{6}$ moneths? Worke and you ſhall finde 15 li.

and

and $\frac{11}{36}$ of a pound, which is the neat gaines that the first Merchant hath after the rate aforesaid.

*A Merchant hath bought Holland at 7 s 3 d the Ell ready money, and hee selleth the same againe for 8 s 4 d the Ell to be paied $\frac{1}{4}$ part in ready money, more $\frac{1}{3}$ part at 2 moneths, and the rest at 4 moneths. The question is now to know how much the first Merchant doth gaine vpon the 100 pounds in twelue moneths after that rate?*

*Answer.* According to the direction deliuered you in the rule of payment, the ready money is not to be multiplied. Then working for the other two payments to finde out the true proportion at what time they ought to be paid at once, you shall finde for $\frac{1}{3}$ at two moneths, $\frac{2}{3}$ of a moneth. And the rest of the money which is $\frac{5}{12}$ multiplied by his terme 4 moneths, yeeldeth $1\frac{2}{3}$ moneths, both which added together make $2\frac{1}{3}$ moneths, the iust time that both the payments ought to be performed at once. And therefore say by the first part of the Rule of 3 composed, if $7\frac{1}{4}$ in $2\frac{1}{3}$ moneths doe gaine $\frac{13}{240}$ of a pound, what shall 100 pounds gaine in 12 moneths after that rate? worke and you shall finde $76\frac{172}{203}$ pounds. And so much doth hee gaine vpon 100 pounds in twelue moneths.

*A Merchant hath bought 30 clothes at 6 pounds the peece for ready money. Afterward he selleth tenne of them for 7 pound the peece, for three*

*three moneths terme. And the other twenty he ſelleth for* 8 *pound the piece for* 4 *moneths terme. The queſtion is now what hee gaineth vpon* 100 *pounds in twelue moneth?*

*Anſwer.* Firſt finde the value of the thirty clothes, which amount to 180 pounds. Secondly, ſeek what the tenne pieces come to at 7 punds, and what the twenty pieces come to at 80 poũds; the one comes to 70, & the other to 160. both which together make 230, which is 50 pounds more then they coſt. Thirdly, as I haue taught you in the Rule of payment, proportionate the firſt and ſecond prices vnto the proportion they beare vnto 230, the product of their two prices, and you ſhall find $\frac{7}{23}$ for the firſt, & $1\frac{16}{23}$ for the latter. Then fourthly, multiply thoſe parts by their times, and you ſhall haue $\frac{21}{23}$ and $\frac{64}{23}$ both which together maketh three whole moneths, and $\frac{17}{23}$ of a moneth, which is the iuſt time that both thoſe payments ought to be paid at once.

Then ſay by the firſt part of the Rule of three compoſed. If 180 pounds in $3\frac{17}{23}$ moneths do gaine 50 pounds, what ſhall 100 gaine in twelue moneths? Multiply and diuide, and you ſhall finde $90\frac{10}{51}$ pound, and ſo much doth he gaine vpon 100 pounds in twelue moneths.

*A Merchant hath bought cinamon which coſt him* 9 *ſhillings the pound ready money. The queſtion is now at what price hee ought to ſell the* 100 *weight. To wit,* 112 *pounds to be paid the* $\frac{1}{4}$ *at two moneths, and the reſidue*

at

*at the end of three moneths, so that he may gaine after the rate of ten pounds vpon 100 pounds for twelue moneths.*

*Answer.* Seeke first by the Rules of payment at what terme both the payments ought to be paid at once, where the $\frac{2}{4}$ multiplied by his terme two moneths, maketh $\frac{2}{4}$ moneths.

Likewise the next paiment, which is $\frac{3}{4}$ multiplied by his terme three moneths, maketh $2\frac{1}{4}$ moneths, both which added together, maketh $2\frac{3}{4}$ moneths, which is the time, that both the payments ought to be paid at once. Then say by the Rule of three, if 12 moneths doe giue mee 10 pounds, what will $2\frac{3}{4}$ moneths giue? Multiply and diuide, and you shall finde $2\frac{7}{14}$ pounds. Then say againe by the Rule of three, If one pound cost mee 9 s, what will 112 pounds cost? Multiply and diuide, & you shall finde 50 li--8 s. Then say once againe: If 100 pound doe giue $102\frac{7}{14}$, what will $50\frac{2}{7}$ pounds giue? Multiply and diuide, and you shall finde 51 li--11 s--$1\frac{1}{7}$ d, and for that price ought I to sell 112 pound of Cinamon to be paid at the two seuerall payments aforesaid, to gaine thereby after the rate of 10 pounds vpon the 100 pound in twelue moneths.

Briefe

## Briefe Rules for our hundreth waight here at London, which is after 112 pound for the 100.

Item, *who that multiplieth the pence that one pound weight is worth by 7, and divideth the product by 15, shall finde how many pounds in money 112 pound weight is worth.*

*And contrariwise, he that multiplieth the pounds that 112 pounds weight is worth by 15, and divideth the product by 7, shall find how many pence in money the one pounds weight is worth.*

### Example.

At 10 pence the pound weight, what is 112 pounds weight worth?

*Answer.* Multiply 10 by 7, and thereof commeth 70, the which diuided by 15, and you shall find $4\frac{2}{3}$ pounds. And thus the 112 pounds is worth 4 li, 13 s, 4 d, after the rate, of 10 pence the pound aforesaid.

At 6 pounds the 112 pounds weight, what is one pound worth?

*Answer.* Multiply 6 by 15, and thereof commeth 90: the which diuide by 7, and you shall finde $12\frac{6}{7}$ d. So much is one pound worth when the 112 pounds did cost 6 pounds:

## The eight Chapter intreateth of Tares and allowances of Merchandize sold by weight, and of losses and gaines therein, &c.

AT 16 pound the 100 Suttle, What shall 895 pound suttle bee worth, in giuing 4 pound weight vpon euery 100 for treat?

Answer. *Adde 4 vnto 100, and you shall haue 104. Then say by the Rule of three: If 104 be worth 16 pounds what are 895 pounds worth? Multiply and diuide, and you shall finde 237 li, 13 ſ, 10 $\frac{3}{13}$ d, and so much shall the 895 pounds weight be worth.*

*Item*, at 3 ſ 4 d the pound weight shall 754 $\frac{1}{3}$ pound be worth, in giuing 4 pounds weight vpon euery 100 for treat?

*Answer.* See first by the rule of three what the 100 pound is worth, saying: If one cost 3 $\frac{1}{3}$ ſ, what 100? Multiply and diuide, and you shal finde 16$\frac{2}{3}$ pounds. Then adde 4 vnto 100, and they are 104. Then say againe by the rule of three, if 104 be sold for 16$\frac{2}{3}$ pounds, for how much shall 754 $\frac{1}{3}$ be sold for? Multiply and diuide, & you shall find 120 li, 18 ſ, 3 $\frac{3}{13}$ d. And for so much shall the 754 $\frac{1}{3}$ pound bee sold for at 3 ſ 4 d the li, in giuing 4 vpon the 100.

*Other necessary briefe rules there are for the finding of treats, or casting vp of chests of Sugar, &c.*

*&c. which for that it is a mystery, I omit: If any lacke instruction that way, they shall finde me ready to pleasure them.*

*Item*, if 100 pounds be worth 36 s 8 d. what shall 860 pounds bee worth in rebating 4 pounds vpon euery 100 for tare and cloffe?

*Answer.* Multiply 860 by 4, and thereof commeth 3440, the which diuide by 100, and you shal haue $34\frac{3}{7}$ pounds, abate $34\frac{3}{7}$ from 860 and there will remaine $825\frac{4}{7}$ pounds. Then, say by the rule of three, If 100 pound cost $36\frac{4}{7}$ s. what will $825\frac{4}{7}$ cost after that rate? Multiply and diuide, and you shall finde 15 li. 2 s $8\frac{16}{35}$ d. And so much shall the 860 cost in rebating 4 pounds vpon euery 100, for tare and cloffe.

Item, *whether doth he losse more that giueth 4 pounds vpon the* 100, *or hee that rebateth 4 pounds vpon the* 100?

*Answer.* First note, that he that giueth 4 pounds on 100, giueth 104 for 100. And he which rebateth 4 pounds vpon the 100, giueth the 100 for 96. Therefore say by the rule of three, If 104 bee deliuered for 100, for how much shall the 100 be deliuered? Multiply and diuide, and you shall find $96\frac{8}{13}$, and he which rebateth 4 in the 100, maketh but 96 pounds of 100, so that he loseth 4 pounds in the 100 and the other which giueth 4 li. vpon the 100 looseth but $3\frac{11}{13}$ pounds vpon the 100. Thus you may see, that he which rebateth 4 pounds

in the 100. loseth more by $\frac{11}{13}$ pound in the 100 pounds, then the other which gaue 4 pounds vpon the 100, for tare and cloffe.

*If* 100 *pounds of any thing coſt me* 23 ſ. 4 d. *the queſtion is, how I ſhall ſell the pound, to gaine after the rate of* 10 *pounds, vpon the* 100 *pound.*

*Anſwer.* Say by the rule of three, if 100 pounds giue 110 pounds, what ſhall $23\frac{1}{3}$ ſ giue? Multiply and diuide, and you ſhall finde $1\frac{17}{60}$ pounds. Then ſay againe, If 100 pound bee worth $1\frac{17}{60}$ pounds, what is one pound worth? Multiply and diuide, and you ſhall find 3 d $\frac{2}{13}$. And ſo much is the pound worth in gaining 10 pounds vpon the 100.

Item, *A Grocer hath bought C. weight of commoditie, for* 6 li. 10 ſ. *The queſtion is now, to know how many pounds thereof he ſhall ſell for* 33 ſ. 4 d. *to gaine* 20 ſ. *in the C. weight.*

*Anſwer.* Adde 20 ſ. vnto 6 li. 10 ſ. and they make 7 li-10 ſ. Then ſay, if $7\frac{1}{2}$ pound yeeld me 112 pound, what ſhall $1\frac{1}{3}$ pounds yeeld? Multiply and diuide, and you ſhall finde $24\frac{1}{3}$ pound. And ſo many pound ought he to ſell to gaine 20 ſ. in his C weight.

*If one pound weight coſt* 3 ſ. 4 d. *and I ſell the ſame againe for* 4 ſ. *what is gained in a* 100 *pound of money laid out in that commodity?*

*Anſwer.* You may ſay, If $3\frac{1}{3}$ ſ. giue 4

wh

what will 100 pound gaine? But then when you haue found, you must subtract 100 pounds out of the Product, the rest is your neat gaine, or else to produce the neat gaine in your worke at the first. Subtract the iust price out of the ouerprice, as I taught before in the first beginning of Losse and Gaine, and your conclusion shall be all one. Multiply and diuide, by which of the two wayes you thinke good, and you shall finde that he gaineth 20 pounds, in the 100 pound.

*Item, if the pound weight which cost 4 l. be sold againe for 3 l—4 d. I demand what is lost in the 100 pounds of money?*

*Answer.* Say, If 4 s. lose $\frac{2}{3}$ s. what shall 100 lose? Multiply and diuide, and you shall finde 16 li. 13 s. 4 d. and so much is lost vpon the 100 of money.

*Item, if C. weight of any commoditie cost 45 pounds, & the buyer repenting, would lose 5 pounds in the 100 of money, I demand how the pounds may be sold, his losse to be neither more nor lesse then after the rate aforesaid of 5 by the 100?*

*Answer.* By the Rule of three, if 100 lose 5, what shall 45 lose? Worke, and you shall find 2 $\frac{1}{4}$ pound, which rebated from the principall 45, resteth 42 li. 15 s. Lastly say, if 112 yeeldeth but 42 li. 15 s. what one pound? Multiply and diuide, and you shall find 7 s. 7 d. $\frac{17}{28}$.

And so much is the pound worth after that losse.

*A Grocer hath bought 3 peeces of Raisins, weighing 175 ½ pounds, 182 ¼ pounds: 191 pounds: tare for each frayle 2 ¼ pounds, at 25 ½ s. the C weight. The question is, what they amount to in money?*

I answer, 6 li——3 s——4 $\frac{23}{28}$ d.

*A Grocer hath bought three sacks of Almonds waying 267 ½ pound, Tare 2 pound, 257 ½ pounds tare 2 ½ pound, 252 pound, tare 3 pound, at 2 s. 10 ½ d the pound, what amount they to in money?*

I answer, 110 li——12 s——3 ¼ d.

## The ninth Chapter intreateth of lengths and breadths of Arras and other clothes, with other questions incident vnto length and breadth.

*IF a peece of Arras be 7 Ells and ¼ long, and 5 Ells and ½ broad, how many Elles square doth the same peece containe?*

*Answer.* Multiply the length by the breadth, that is to say, 7 ¼ by 5 ½ And thereof will come 43 $\frac{1}{2}$ Elles: so many Elles square doth the same peece containe.

*Item more, a peece of Arras doth containe 22 Ells square, and if the same were in length 3 ¼ Ells,*

I

*I demand how many Ells in breadth the ſame piece doth containe.*

*Anſwer.* Diuide 22 Els by $3\frac{1}{4}$ and thereof commeth $6\frac{8}{13}$ So many Els doth the ſame containe in breadth.

Item *more, a Merchant hath* $3\frac{1}{4}$ *Ells of Arras, at* $1\frac{1}{3}$ *Ells broad, which hee will change with another man for a piece of Arras, that is* $7\frac{1}{4}$ *Ells ſquare. The queſtion is, how many Ells of that ſquareneſſe ought the firſt Merchant to haue?*

*Anſwer.* Multiply the firſt Merchants piece his length by the breadth, and you ſhall find, it containeth $5\frac{5}{12}$ Ells, which $5\frac{5}{12}$ Ells you ſhall diuide by $7\frac{1}{4}$ and you ſhall finde $6\frac{4}{31}$ Ells, and ſo many Ells of that ſquareneſſe ought the latter Merchant to giue the firſt.

Item, *a Student hath bought* $3\frac{1}{3}$ *yards of broad cloth, at 7 quarters broad, to make a gowne, and ſhould line the ſame throughout with Lambe, at a foote ſquare each skin: The queſtion is now how many skinnes he ought to haue?*

*Anſwer.* Seeke firſt the number of yards ſquare that his cloth containeth, which to doe multiply $3\frac{1}{3}$ his length, by $1\frac{3}{4}$ his breadth, and you ſhall finde $6\frac{1}{3}$ yards ſquare: then ſay by the rule of three, if one yard ſquare giue 9 foot, what ſhall $6\frac{1}{3}$? Work and you ſhall find $55\frac{1}{3}$ skins.

Item *more, a Lawyer hath a rich piece of ſeling come home, which is 24 foot and three inches long, and 7 foot and 2 $\frac{1}{2}$ inches high: the loyner is to be paid by the yard ſquare: The queſtion is, how many yards this piece containeth?*

*Anſwer.* Multiply his length by his breadth, that is to wit, 24 $\frac{1}{4}$ foot by 7 $\frac{1}{4}$ foote, and you ſhall finde 174 $\frac{77}{96}$ foote ſquare, which 174 you ſhall diuide by 9 (for ſo many foote make a yard ſquare) and you ſhall finde 19 yards three foot, and $\frac{77}{96}$ of a foot, and ſo many yards doth this piece hold.

Item *Bought a piece of Holland cloth containing 36 Ells $\frac{1}{3}$ Flemmiſh. The queſtion is how many ells Engliſh it makes?*

*Anſwer.* You muſt note, that fiue Ells Flemmiſh, doth make but three Ells Engliſh.

Therefore ſay by the Rule of three, If 5 Ells Flemmiſh, make but three Ells Engliſh, how many Ells Engliſh will 36 $\frac{1}{3}$ Ells Flemmiſh make? Multiply and diuide, and you ſhall finde 21 $\frac{4}{5}$ & ſo many Ells Engliſh doth 36 $\frac{1}{3}$ Ells Flemmiſh containe. The like is to be done of others.

Item *more, I haue bought 342 Ells Flemmiſh, of Arras worke, at two Ells broad Flemiſh, and I would line the ſame with Ell broad Cannas of Engliſh meaſure. The queſtion is, how many Ells Engliſh will ſerue my turne?*

*Anſwer.* For as much as three Ells Engliſh

liſh are worth fiue Ells Flemmiſh; therefore put 3 Ells Engliſh into his ſquare, in multiplying 3 by himſelfe, which maketh 9. Likewiſe multiply the Engliſh Ell, which is fiue quarters, euery way into himſelfe ſquarely, and you ſhall finde 25, Then multiply 342 which is the length of the piece, by 2, which is the breadth, & thereof commeth 684. then ſay by the Rule of three, as before: if 25 Ells ſquare of Flemmiſh meaſure, be worth 9 Ells ſquare of Engliſh meaſure, what are 684 of Flemmiſh meaſure? Multiply and diuide, and you ſhall finde 246 $\frac{6}{25}$ Ells Engliſh.

The ſame is alſo wrought by the Backer Rule of three, in ſeeking the ſquares contained in the Flemmiſh Ell of two Ells broad (which are 18) and alſo in ſeeking the ſquares contained in the Engliſh Ell (which are 25) then ſay by the Rule of three backward, If 18 quarters require 342 Ells, what ſhall 25 quarters giue? Multiply and diuide by the Rule of three Reuerſe, and you ſhall finde as before 246 $\frac{6}{25}$ Ells Engliſh.

Item *more, at three ſhillings faure pence the Flemmiſh Ell, what is the Engliſh Ell worth after the rate?*

*Anſwer.* Say if three quarters giue 3 $\frac{1}{3}$ ſ, what giueth fiue quarters? Multiply and diuide, and you ſhall finde 5 ſhillings 6 $\frac{2}{3}$ d.

Item, *more, at* 8 ſ, 4 d, *the Flemmiſh Ell ſquare,*

*square, what is the English Ell worth after that rate?*

*Answer.* According to the reason of the last Question, consider that a Flemmish Ell square is equall to nine quarters of a yard English, & an english Ell square is equall to 25 quarters of a yard. Therefore say by the rule of three, if 9 quarters giue 8 $\frac{1}{9}$ s, what 25 quarters? Worke and finde 23 s, 1 $\frac{7}{9}$ pence. And so much is the English Ell worth.

Item *more, at 6 s, 8 d, the Ell square: what shall a piece of cloth cost that is 7 $\frac{1}{2}$ Ells long, and 3 $\frac{1}{4}$ Ells broad?*

*Answer.* Multiply the breadth by the length, and you shall finde 24 $\frac{1}{8}$ Ells square cost 6 $\frac{2}{3}$ s, what 24 $\frac{1}{8}$ Ells. Multiply and diuide, and you shall finde 8 pounds, 2 shillings 6 pence, and so much the same piece of cloth cost.

Item *more, a Mercer sold three pieces of Silke. To wit 24 $\frac{1}{4}$, 13 $\frac{2}{3}$, and 25 yards, at 9 $\frac{1}{4}$ s the yard, and was glad to receiue in part of payment againe, a cloth containing 34 $\frac{1}{2}$ yards at 7 $\frac{2}{3}$ shillings the yard. The question is now, what the Debter is in the Creditors debt? Worke, and you shall finde he oweth the Mercer 22 pounds 3 shillings 2 $\frac{1}{4}$ pence.*

The

## The tenth Chapter entreateth of reducing of Pawnes of Geanes into Englisſh yards.

*NOte, that 100 Pawnes doe make 26 yards, wherevpon three Pawnes $\frac{11}{19}$ doe make one yard, and one Pawne after that rate and proportion is $\frac{11}{19}$ of a yard.*

*In 4563 Pawnes of Geanes, how many yards Engliſh?*

*Anſwer.* Say by the rule of three, if 100 Pawnes doe make 26 yards, what will 4563 Pawnes make? Multiply and diuide, and you ſhall finde 1186 yards $\frac{12}{100}$. So many yards do 4563 Pawnes make.

Otherwiſe, take ſome other number at your pleaſure, as 10 Pawnes, which is the $\frac{1}{10}$ part of 100, then to finde his proportion, take the $\frac{1}{10}$ part of 26, which is $2\frac{1}{5}$, and then ſay alſo by the Rule of three, if 10 Pawnes giue $2\frac{1}{5}$ yards, what will 4563 Pawns giue? Worke, and you ſhall finde 1186 $\frac{12}{100}$ yards, as before.

*More, at 2 ſ—6 d. the Pawnes of Geanes, what will the Engliſh yard bee worth after the rate?*

*Anſwer.* Say by the Rule of three, if $\frac{11}{19}$ of a yard coſt $2\frac{1}{2}$ ſ. what one yard? Multiply and diuide, and you ſhall finde 9 ſ. 7 $\frac{7}{11}$ d.

*More,*

*More if* 346 $\frac{1}{2}$ *Pawnes cost* 30 li. 13 ſ. 4 d. *ſterling, what is that the Engliſh yard after the rate?*

*Anſwer.* Say by the Rule of three, If 346 $\frac{1}{2}$ Pawns coſt 30 $\frac{2}{3}$ pounds, what are 3 $\frac{11}{13}$ Pawns worth (for ſo many Pawnes make a yard) Multiply and diuide, and you ſhall finde $\frac{9209}{27827}$ parts of a pound, which in knowne numbers is worth 6 ſ 9 d $\frac{6271}{9009}$.

## The eleuenth Chapter entreateth of Rules of Loane and Intereſt, with certaine neceſſary queſtions and Proofes incident thereunto, &c.

*ITem, lent my friend 226 pounds for* 5 $\frac{1}{2}$ *moneths ſimply without any Intereſt, vpon condition, to haue the like curteſie againe when I need. But when I came to borrow, he could ſpare mee but* 149 li. 8 ſ 4 d. *The queſtion is now how long time I ought to haue the vſe thereof, to counteruaile my friendſhip before time ſhewed him?*

*Anſwer.* Say by the backer Rule of three, If 326 pounds giue 5 $\frac{1}{2}$ moneths, what time will 149 $\frac{2}{12}$ pounds giue? Multiply and diuide and you ſhall finde twelue moneths, and ſo long time ought I to vſe his money.

### The proofe.

*Item, lent my friend* 149 li. 8 ſ 4 d. *for* 12 *moneths.*

*moneths. The queſtion is now how much money he ought to lend me againe for 5 $\frac{1}{2}$ moneths to recompence my friendſhip ſhewed him?*

*Anſwer.* Say by the backer or reuerſe Rule of three, If 12 moneths giue 149 $\frac{1}{12}$, what ſhall 5 $\frac{1}{2}$ moneths giue? Worke, and you ſhall finde 326 pounds, and ſo much ought he to lend me to requite my gentleneſſe or good turne.

## Two other Branches, yet more, for proofe out of the ſame queſtion.

*Item, lent my friend* 149 li. 8 ſ. 4 d. *for* 12 *moneths, to haue the like friendſhip againe when I need. And comming to borrow of him, hee very curteouſly tooke me* 326 *pounds (for that hee could well then ſpare the ſame.) The queſtion is now, how long I ought to occupy it, not vſurping friendſhip, but in his due time to reſtore it againe.*

*Anſwer.* Say by the Rule of three Reuerſe, if 149 $\frac{1}{12}$ pounds giue 12 moneths, what ſhall 326 pounds giue? Multiply and diuide, and you ſhall finde, that at 5 $\frac{1}{2}$ moneths terme, I ought to reſtore it againe.

## Proofe.

Item, *Lent my friend* 326 *pounds for* 5 $\frac{1}{2}$ *moneths. The queſtion is now, how many pounds hee ought to lend mee for* 12 *moneths, to recompenſe*

*pence this pleaſure againe?*

*Scholer.* Worke by the Rule of three, Reuerſe, as you haue done before, and you ſhall finde 149 li—8 ſ—4 d.

## Againe, foure other ſelected Queſtions of Loane and Intereſt, all out of one branch; and each one alſo a neceſſarie Queſtion, and a particular proofe to other.

ITem, *Lent my friend* 430 *pounds at Intereſt for three moneths, to receiue after the rate of* 8 *pounds, in the* 100 *pounds for* 12 *moneths. The queſtion is, what the Intereſt cometh to?*

You may, if you pleaſe, worke it at two workings by the Rule of three direct, in ſaying: If 12 moneths giue 8 pounds, what giueth three monethsſ Multiply and diuide, and it giueth 2 pound.

Then for the ſecond worke ſay: If 100 pound yeeld 2 pounds, what yeeldeth 430 pound? Multiply and diuide: and you ſhall find 8 li. 12 ſ. and ſo much comes the loane of 430 pounds to for 3 moneths after the rate of 8 pounds in the 100 pounds of 12 moneths.

Otherwiſe wrought thus by the Rule of three at twice alſo.

If 100 pound giue 8 pounds, what giueth 430 pounds? Multiply and diuide, and you ſhall finde 34 pounds $\frac{2}{5}$. Then againe for the ſecond worke ſay: If 12 moneths giue 34 pounds

pounds ⅗, what giueth three moneths? Work and finde 8 li, 12 ſ as before.

Otherwiſe yet at one working: By the firſt part of the rule of fiue numbers forward, in ſaying, if 100 pounds in 12 moneths, gaine 8 pounds, what ſhal 430 pounds gaine in three moneths? Multiply the firſt by the ſecond for your Diuiſor, and the other three the one into the other for the Diuidend, and you ſhall find eight pounds 12 ſhillings as aforeſaid.

## Proofe.

Item, *a friend of mine receiued of me* 8 *pounds* 12 *ſhillings for the Intereſt and vſe of* 430 *pounds for three moneths terme: The queſtion is now, what he tooke in the* 100 *pounds for* 12 *moneths after that rate?*

*Anſwer.* For moſt briefe, ſay by the firſt part or rule of fiue numbers forward: If 430 pounds in three moneths did pay 8 li. 12 ſ. what doth 100 pounds in 12 moneths take after the rate? Worke, and you ſhall finde 8 pounds, and ſo much he tooke vpon the 100 pounds for twelue moneths.

## A third Queſtion and proofe alſo by the Backer Rule of 5 Numbers.

Item, *lent my friend* 430 *pound to receiue for the intereſt thereof, after the rate of* 8 *pounds*

in

*in the* 100 *for* 12 *moneths. The queſtion is now how long time my friend ought to giue the vſe thereof, that it may bee returned with* 8 li, 12 ſ, *gaines?*

You may worke it, if you pleaſe, by the Rule of three direct at twice, in ſaying: If 100 pound yeeld 8 pounds, what yeeldeth 430 pound? Multiply and diuide, & find 34 pound and $\frac{2}{5}$.

Then againe for the ſecond worke ſay, if $34\frac{2}{5}$ pounds, giue 12 moneths, what giueth $8\frac{1}{2}$ pounds, Multiply & diuide, & you ſhal find three moneth, & ſo long time ought my friend to vſe it to returne with 8 li, — 12 ſ gaine.

Otherwiſe at one working by the Backer Rule of 5 numbers, in ſaying: If 100 pounds in 12 moneths doe gaine 8 pounds, how long time ſhal 430 pounds be a gaining of 8 poũds 12 ſ? Multiply the firſt and the ſecond into the laſt for your diuidend, and the third and fourth multiply together for your diuiſor, and then diuide, and you ſhall finde 3 moneths, the iuſt time that my friend ought to vſe it to returne it with 8 li, 12 ſ gaine.

## A fourth driued queſtion out of this Branch, which is a proofe of this laſt, and alſo of the other two going before.

*ITem, how much mony ought a Merchant to deliuer after* 8 *pounds in the* 100 *for* 12 *moneths, that in three moneths he may gaine* 8 li, 12 ſ?

*Anſwer*

*Anſwer.* You may alſo, if you pleaſe, worke it by the Golden Rule of three at twice: firſt ſaying; If three moneths giue 8 ℔ pound, what 12 moneths gaine? You ſhall finde 34 ℔. Then ſay again, If 8 pounds be come of 100 pounds what ſhall come of 34 li 8 ſ? Worke, and you ſhall finde the anſwer to the queſtion, which is 430 pounds, and ſo much ought the Merchant to deliuer.

But moſt briefly it is anſwered by the Backer Rule of fiue numbers, where I argue thus, ſaying: If 100 li, be 12 moneths a gaining of 8 li, then but for three moneths terme only to tak 8 li, 12 ſ, muſt needs be a good round ſumme: to worke it, ſet your numbers thus: 100—12 8—2—8 ℔: multiplying the firſt into the ſecond, & alſo by 43 the product of the fifth, for your diuidend, and the third and fourth together with 5 the Denominator of your fraction for your Diuiſor: then diuide, and you ſhall find as before 430 pounds: the true ſolution to your queſtion.

## The twelfth Chapter intreateth of the making of Factors, which is taken in two ſorts.

THe firſt is, when the eſtimation of the Factor is taken vpon the ſending of the Merchant; as if the eſtimation of his perſon be ⅓ it is vnderſtood that he ſhall haue ⅓ of the gaine, and the Merchant the other ⅔.

The other ſort is, when the eſtimation of

his making is out of the sending of the Merchant, as if the order and agreement between them were such, that the Merchant shall put in 800 li, and the Factor for his making shall haue $\frac{1}{4}$: neuertheleſſe he shall haue but $\frac{1}{7}$ of the gaine or profit, for the $\frac{1}{4}$ of 800 is 200 (for the estimation of his making) which with the 800 pounds in all make 1000 pounds, whereof the 200 pounds, is $\frac{1}{7}$.

A Merchant doth put in 800 pound into the hands of his Factor, vnder such condition that the said Factor shall haue $\frac{1}{4}$. And after certaine time, they finde in profit 124 li, 6 ſ 8 d. I demand how much the Merchant shall haue hereof, and how much ought the Factor to haue?

Answer. *When the estimation of the Factor is out of the sending of the Merchant, it maketh,*

| li | ſ | d | | |
|---|---|---|---|---|
| 99 | 9 | 4 | for the Merchant. | |
| 24 | 17 | 4 | for the Factor. | |

*But if that his estimation bee at the sending of the Merchant, then it maketh but,*

| li | ſ | d | | |
|---|---|---|---|---|
| 93 | 5 | 0 | for the Merchant. | |
| 31 | 1 | 8 | for the Factor. | |

*For the Merchant is then to haue $\frac{3}{4}$, and the Factor $\frac{1}{4}$.*

A Merchant doth put into the hands of his Factor 800 pounds, and the Factor 400 pounds to haue the $\frac{1}{3}$ part of the profit: I demand now for how much his perſon is eſteemed, when the ſame is counted vpon the ſending of the Merchant?

Anſwer. *According to the tenor and order before prescribed in the first Rule, that is, if his estimate be $\frac{1}{4}$ he shall haue the $\frac{1}{4}$ of the gaine. Therefore say by the Rule of three direct, If $\frac{1}{4}$ taken put in 400 pound, what is the estimate, or putting in of $\frac{1}{3}$ taking? Multiply and diuide, and you shall finde 320 pounds, and so much is the person of the Factor estimated.*

Otherwiſe:

To finde the eſtimation of the perſon of the Factor, you ſhall conſider, that ſeeing it was agreed betweene them, that the Factor ſhould take the $\frac{1}{3}$, then the Merchant ſhall haue the reſidue, which are $\frac{2}{3}$: wherefore the gaine of the Merchant vnto that of the Factor is in ſuch proportion as 5 vnto 4. Then if you will know the eſtimation of the perſon of the Factor: ſay if 5 giue 4, what will 400 giue? Multiply and diuide, and you ſhall finde 320 pound. And ſo much is the perſon of the Factor eſteemed to be worth.

Other conditions then theſe aforeſaid, may alſo bee betweene Merchants and Factors, without reſpect either of ſending,

or not ſending of the Merchant, where moſt commonly the eſtimation of the body of the Factor is in ſuch proportion of the ſtocke which the Merchant layeth in, as the gaine of the ſaid Factor is vnto the gaine of the Merchant. As thus, If a Merchant do deliuer into the hands of his Factor 400 pound and he to haue halfe the profit: the perſon of the ſaid Factor ſhall be eſteemed to be worth 400 pound: and if the Factor do take but $\frac{1}{3}$ of the gaine, hee ſhould haue but $\frac{1}{3}$ ſo much of the gaine as the Merchant taketh, which muſt haue $\frac{2}{3}$, wherefore the perſon of the Factor is eſteemed but the $\frac{1}{2}$ of that which the Merchant layeth in, that is to ſay, 200 pound.

And if the Factor did take the $\frac{2}{7}$ of the gaine, then the Merchant ſhall take the reſidue which are $\frac{5}{7}$, wherefore the gaine of the Merchants vnto the Factor is then in ſuch proportion as 3 vnto 2: whereupon if you will then know the eſtimation of the perſon of the Factor, ſay, If three giue 2, what ſhall 400 giue? Worke, and you ſhall finde $266\frac{2}{3}$ pounds. And ſo much is the perſon of the Factor eſteemed to be worth.

And if the Merchant ſhould deliuer vnto his Factor 400 pound, and the Factor would lay in 80, and his perſon, to the end he might haue the $\frac{1}{5}$ of the gaine, I demand how much ſhall his perſon be eſteemed?

Anſwer. *Abate* 80 *from* 400; *and there will remaine*

*remaine 320. And at ſo much ſhall his perſon bee eſteemed.*

A Merchant hath deliuered vnto his Factor 900 pounds to gouerne in the trade of Merchandize, vpon condition that he ſhall haue the $\frac{1}{3}$ of the gaine, if any thing be gained, and alſo to beare the $\frac{1}{3}$ of the loſſe, if any thing be loſt. Now I demand how much his perſon was eſteemed at?

Anſwer. *Seeing that the Factor taketh the $\frac{2}{3}$ of the gaine, his perſon ought to bee eſteemed as much as $\frac{1}{2}$ of the ſtocke, which the Merchant layeth in: that is to ſay, the $\frac{1}{2}$ of 900 pound, which is 450. The reaſon is, becauſe $\frac{2}{3}$ of the gaine that the Factor taketh, is the $\frac{1}{3}$ of the $\frac{1}{3}$ of the gaine that the Merchant taketh, and ſo the Factor his perſon is eſteemed to be worth 450 pounds.*

A Merchant hath deliuered vnto his Factor 600 pound, and the Factor layeth in 250 pound and his perſon. Now becauſe he layeth in 250 pounds and his perſon, it is agreed betweene them, that hee ſhall take the $\frac{2}{7}$ of the gaine. I demand for how much his perſon was eſteemed?

Anſwer. *For as much as the Factor taketh $\frac{2}{5}$ of the gaine, he taketh $\frac{2}{3}$ of that which the Merchant taketh, for $\frac{2}{7}$ are the $\frac{2}{3}$ of $\frac{3}{7}$. And therefore the Factors laying in ought to be 400 pound, which is $\frac{2}{3}$ of 600 pound that the Merchant layed in. Then ſubtract 250, which the Factor did lay in from 400 pound, which ſhould haue beene his*

*whole ſtocke, and there remaineth* 150 *pound for the eſtimation of his perſon.*

More, a Merchant hath deliuered vnto his Factor 800 pound, vpon condition that the Factor ſhall haue the gaine of 160 pound, as though hee laid in ſo much ready money: I demand what portion of the gaine the ſaid Factor ſhall take?

Anſwer: *See what part the* 160 *(which the Factor layed in) is of* 960, *which is the whole ſtocke of their company, and you ſhall finde* $\frac{1}{6}$. *And ſuch part of the gaine ſhall the Factor take.*

*But in caſe, that in making their couenants, it were ſo agreed betweene them, that the Factor ſhould haue the gaine of* 160 *pound of the whole ſtocke which the Merchant layeth in, that is to ſay, of the* 800 *pound: then ſhould the Factor take* $\frac{1}{5}$ *of the gaine: for* 160 *is* $\frac{1}{5}$ *of* 800 *pound.*

## The thirteenth Chapter intreateth of Rules of Barter, and exchanging Merchandize, which is diſtinct into ſeuen Rules, with diuers other neceſſarie queſtions incident thereunto.

### The firſt Rule.

TWo Merchants willing to change their Merchandize the one with the other: The one

one hath 24 broad cloathes at 10 li-10 ſ, the peece: The other hath Mace at 12 ſ, the pounds: The queſtion is, how many pounds of Mace he ought to giue for his Cloth, to ſaue himſelfe harmeleſſe and be no loſer?

Anſwer. *Seeke firſt by the Rule of three, what the 24 clothes coſt at 10 pound 10 ſhillings the peece, and you ſhall finde 252 pound. Then to finde the quantity of Mace, ſay againe by the Rule of three, If 12 ſhillings buy one pound, what ſhall 252 pound buy me? Worke, and you ſhall find 420 pound of Mace: and ſo many pound ought hee to giue for his Cloathes.*

## The proofe.

Two barter. The one hath 420 pounds of Mace at 12 ſ the pound. to barter or change broad cloathes at 10 pounds 10 ſhillings the peece. The queſtion is, how many broad cloathes he ought to giue for all his Mace.

Anſwer. *Firſt ſay, if one coſt 12 ſ, what 420? you ſhall finde 5040 ſ. Then ſay againe, If 10 $\frac{1}{2}$ pounds giue 1 cloth, what ſhall 5040 ſhillings giue? Worke and you ſhall finde 24 cloathes your deſire.*

## The ſecond Rule.

Two change Merchandize for Merchandize: The one hath Pepper at 2 ſhillings 4 pence the pound, to ſell for ready money.

But in barter hee will haue lesse then three shillings the pound. And the other hath Holland at fiue shillings 6 pence the Ell ready mony. The question is now at what price hee ought to deliuer the Ell in the barter to saue himselfe harmelesse.

Answer. *Say by the Rule of three direct If* 2 $\frac{1}{3}$ *ſ ready money giue* 3 *ſ, in barter, what shall* 5 $\frac{1}{3}$ *giue in barter? You shall finde* 7 $\frac{1}{14}$ *ſ, and at that price ought the second Merchant to sell his Holland in barter.*

## The proofe.

Two barter. The one hath Holland at 5 ſ 6 pence the Ell to sell for ready mony, And in barter he will haue 7 $\frac{1}{14}$ ſ. The other hath Pepper at 2 ſ—4 d, the pound, to sell for ready mony. The question is now, how hee ought to sell in barter?

Answer. *Say by the Rule of three direct, if* 5 $\frac{1}{3}$ *ready mony giue* 7 $\frac{1}{14}$ *ſ in barter, what ought* 2 $\frac{1}{3}$ *ſ to take in barter: Multiply and diuide, and you shall finde* 4 *ſ your desire.*

## The third Rule.

Two barter: The one hath cloth of Arras at 30 ſ the Ell ready mony, but in barter he wil haue 35 $\frac{1}{3}$ ſ. And the other hath white wines, which he deliuered in barter for 16 pounds the Tunne. The question is now, what his wines

wines coſt the Tunne in ready mony.

Anſwer. *Say by the Rule of three direct, If* 35 ½ ſ, *in barter, giue but* 30 ſ *ready mony, what did* 16 *pound in barter coſt? Worke, and you ſhall finde* 13 li--10 ſ $\frac{30}{71}$. *And ſo much coſt his wines for a Tunne ready mony.*

## The prooſe.

Two barter merchandiſe for merchandiſe: The one hath white wines at 13 li,--10 : $\frac{30}{71}$ ſ the Tunne to ſell for ready money. But in barter he deliuered it for 16 pounds. The other, to make his match good and ſaue himſelfe harmleſſe, deliuereth Arras at 35 ½ ſ the Elle. The queſtion is now, what an Elle of his Arras coſt in ready mony.

Anſwer. *Say by the Rule of three direct: If* 16 *pounds in barter giue but* 13 li--10 $\frac{30}{71}$ ſ *in ready mony, what ſhall* 35 ½ ſ *yeeld in barter? worke and you ſhall finde* 30 ſ, *your deſire.*

## The fourth Rule,

*Two barter. The one hath Kerſeys at* 24 *pounds the peece ready money. But in barter he will haue* 18 *pounds. And yet he will haue the* ⅓ *part of his ouerprice in ready mony. And the other hath Ginger at eight groates the pound, to ſell for ready mony, The queſtion is, how hee ought to deliuer the Ginger by the pound in barter to ſaue himſelfe harmeleſſe, and make the barter equall.*

*Anſwer.*

*Answer.* Item, for the working of this question, and such other the like, you must vnderstand, if the party ouersselling his wares, require to haue also some portion in ready money, as $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$, &c. Then shall you first rebate the same demanded part, whatsoeuer it bee, from the ouerprice, and also from the iust price. And those two numbers that shall remaine after the subtraction is made, shall bee the two first numbers in the Rule of three. And the iust price of the same Merchandize shall be the third number, which by the operation of the Rule of three direct, shall yeeld you a true solution, how, and at what price you shal ouersel that your merchandize, to saue your selfe harmelesse, and make the barter equall.

Example.

Take the $\frac{1}{3}$ (of eighteene) which is the ouerprice of his cloath, which $\frac{1}{3}$ of eighteene is sixe, which you must subtract from 18, there rest 12. And also abate it from 14, which is the iust price of the cloath, and there remaineth 8, which 8 and 12 are the two first numbers in the Rule of three. Then take eight groates or 2 $\frac{2}{3}$ shillings for the third number. Then say by the Rule of three direct. If 8 pounds giue 12 pounds, what

14 ——— 18
6 ——— 6
8 ——— 12

what ſhall 2 ⅓ ſ giue? Multiply and diuide, and you ſhall finde 4 ſ. And for ſo much ſhall the ſecond Merchant ſell his Ginger, or his commodity in barter, to ballance the ſame equall.

## The proofe.

*Two barter: The one hath fine Kerſeys at* 14 *pounds the peece ready money: But in barter he will haue* 18 *pounds, and yet hee will haue the* ⅓ *part of his ouerprice in ready money: And the other hath Ginger, which he hauing cunning enough to make the barter equall, deliuered in barter for* 4 ſ. *the pound. The queſtion is now, what his Ginger coſt him in ready money?*

*Anſwer.* After you haue made the ſubtraction, abating 6 the ⅓ part of 18, both from 18 and 14 (as before was taught you:) then will there remaine 8 and 12 for your two firſt numbers in the Rule of three. Then ſay, If 12 giue 8, what ſhall come of 4 the ouer-price of the pound of Ginger, multiply and diuide, and you ſhall finde 2 ſhillings 8 pence your deſire.

*Two Merchants barter merchandiſe for merchandiſe. The one hath* Denſhire *whites at* 7 li—13 ſ. 4 d. *the peece ready money: but in barter he doth them away for* 8 li–3 ſ–4 d. *and yet he will haue the* ⅓ *part of his price in ready money. And the other hath Cottens at* 3 *pounds the peece ready money. The queſtion is now, at what price he ought*

*ought to sell or exchange his Cottens in barter to saue himselfe harmelesse, and make the barter equall?*

| | | | | | |
|---|---|---|---|---|---|
| 7 | 13 | 4 | | 8 | 3 | 4 |
| 2 | 14 | $5\frac{1}{4}$ | | 2 | 14 | $4\frac{1}{3}$ |
| 4 | 18 | $10\frac{2}{3}$ | | 5 | 8 | $10\frac{2}{3}$ |

*Answer.* First seeke the $\frac{1}{3}$ part of 8 l—3 s. 4 d. which is, 2 li—14—$5\frac{1}{3}$ d. which rebated from 8 l—3 s—4 d. there resteth, as appeareth by the example abouesaid, 5 l–8 s—$10\frac{2}{3}$ pence, which is $\frac{2}{3}$ parts of 8—3—4 d. also rebated from 7—13—4 d. there resteth, 4 l—18 s—$10\frac{2}{3}$ d. the two first numbers in the Rule of three, and the 3 pounds, which is the neat price of the peece of Cotten, is the third number; Then say by the Rule of three direct, as was taught before: If 4 li–18 s–$10\frac{2}{3}$ d. giue 5 li–8 s–$10\frac{2}{3}$ d. what shall 3 pounds giue? multiply and diuide, and you shall finde 3 li. 6 s–o $\frac{72}{80}$ pence, the iust price that he ought to deliuer his Cottens in barter.

## The fifth Rule.

*Two Merchants will change merchandise for merchandise. The one hath Kerseys at 43 l. the peece to sell them for ready money. And in barter, hee will sell them for 56 l. 8 d. and hee will gaine after 10 pounds vpon the 100 pounds. And yet hee will*

*will haue the $\frac{1}{2}$ of his ouerprice in ready money. The other hath flaxe at* 3 d. *the pound ready money. The queſtion is now, how he ſhall ſell the pound of his flaxe in barter?*

*Anſwer.* See firſt at 10 pounds vpon the 100 pounds what the 56 $\frac{2}{3}$ ſ. commeth to, in ſaying (by the Rule of three direct) If 100 pounds giue 110 pounds, what 56 $\frac{2}{3}$ ſ? Multiply and diuide, and you ſhall finde 3 li-2 ſ-4 d. of which the $\frac{1}{2}$ that he demandeth in ready money, is 1 li.——11 ſ——2 d: the ſame 31 ſ——2 d. abated from 40 ſ. and alſo from 56 ſ—8 d. there will remaine 8 ſhillings 10 d. and 25 ſ—6 d. for the two firſt numbers in the Rule of three, and 3 pence the price of the pound of flax for the third number. Then multiply and diuide, and you ſhall find 8 $\frac{35}{53}$ d. And for ſo much ſhall he ſell the pound of flaxe in barter.

## The ſixth Rule.

*Two are willing to exchange merchandiſe: the one hath Norwich Grograns at* 25 ſ. *the peece ready money: and in barter he will haue* 30 ſ. *and he will haue the $\frac{1}{4}$ part of his ouerprice in ready money. The other hath Norwich ſtockings at* 40 ſ. *the dozen to ſell for ready money. But in as much as the firſt Merchants Grogranes are no better, hee would deliuer them ſo to ballance the barter, that he may gaine after* 10 *pounds in the* 100 *pounds. The queſtion is now, how he ſhall*

*ſell*

*ſell his Hoſe the dozen in barter according to his requeſt.*

*Anſwer.* Say, if 100 giue 100, what ſhall 40 ſ. giue, which is the iuſt price of the dozen of ſtockings? Multiply and diuide, and you ſhall finde 44 ſ. Then take the $\frac{1}{4}$ of 30 ſ. which is 7 ſ. 6 d. and ſubtract it from 25 ſ. and alſo from 30 ſ. and there will remaine 17 ſ——6 d. and 22 ſ——6 d. for the two firſt numbers in the Rule of three, and 44 ſhillings, which is the iuſt price (with his gaine in the dozen of ſtockings) for the third number. Then multiply and diuide, and you ſhall finde 56 ſ 6 $\frac{6}{7}$ d. and for ſo much he is to ſell his doſen of ſtockings in barter.

## The ſeuenth Rule.

*Two Merchants will change their merchandiſe one with the other. The one hath 720 Ells of Cambrick at 5 ſ the Ell to ſell for ready money, but in barter hee requireth 6 ſ. 8 d. And yet notwithſtanding hee loſeth by it after 10 pounds vpon the 100 pounds, wherevpon hee requireth one halfe of his ouerprice in ready money: and the other Merchant hauing skill enough to make the barter equall, deliuered Engliſh Saffrons at 30 ſ. the pound. The queſtion is now, what his Saffrons coſt the pound in ready money?*

*Anſwer.* You muſt firſt ſeeke what is loſt vpon

vpon the 100 pound, which to doe, you may ſay, (if you pleaſe) If 100 pound loſe 10, what ſhall 6 ſ loſe? Worke, and you ſhall finde 1 ſ (or 8 d) which muſt be rebated from 6 ſ-8 d ſo reſteth 6 ſ ſtill. Or you may ſay, if 100 pound giue me but 90 pounds, what ſhall 6 ſ 8 d giue? Worke this way either, and you ſhall finde alſo as before directly in your quotient 6 ſ your deſire. Then are yeu next to caſt vp what the 720 Elles of Cambrick commeth to at 6 ſ 8 d the Ell, and you ſhall finde 240 pounds: the ⅓ whereof the Cambricke Merchant will haue in ready mony, (which is 120 pounds): Nextly you muſt caſt what the Cambrick commeth to after his loſſe in the 100 pound, which, as you found, is but 6 ſ an Ell, and you ſhall find 216 pounds: Now muſt you ſubtract his ready mony (which is 120 pounds in all,) out of 240 pound, and alſo out of 216 pound and there will remaine 120 pounds, & 96 pounds for you firſt two numbers in the Rule of three, & 30 ſhillings is the ouerprice of your Saffron for the third number: Then multiply and diuide, and you ſhall find 24 ſhillings. And ſo much did his Saffrons coſt in ready mony.

*Two Merchants barter. The one hath 50 cloths to put away for ready mony at 11 pounds, the cloth, & in barter putteth them away for 12 pounds, taking Holland Cloth at 20d the Flemmiſh Elle, which was worth no more but 18 d. The queſtion is now, what Holland payeth for the Cloath,*

*and*

*and what hee winneth or loſeth by the bargaine?*

*Anſwer.* 50 Cloathes at 11 pounds the cloth commeth to 550 pounds, and put away at 12 pounds the peece, maketh 600 pound. Then to find what Holland payth for the Cloth, ſay by the Rule of three direct, If 20 d buy one Ell what 600 pounds; Worke and you ſhall find 7200 Ells. Now to find the eſtate of his gaine or loſſe, you muſt ſeeke what his 7200 Elles commeth to at 18 d the Elle: Worke by the Rule of Proportion direct, and you ſhall find 540 pounds, which is not ſo much as his cloathes were worth in ready money by 10 pounds: and ſo much loſt the firſt Merchant by his exchange.

*A Venetian hath in* London 100 *peeces of ſilke, to put away for ready meny at* 3 *pounds the peece. But in barter hee deliuered them for* 4 *pounds the peece, taking Wools of a Felmonger at* 7 li. - 10 ſ *the C. weight, which was worth no more but* 6 *pounds the C, ready money. The queſtion is now, what wools payeth for the ſilkes, and which of them winneth or loſeth by the barter?*

*Anſwer.* 100 peeces of ſilke at 3 pound, is in al 300 pounds, & 4 pounds, is 400 pouds. Then to find what wools payeth for the ſilke, ſay by the Rule of three direct: If $7\frac{1}{3}$ buy me 100 weight, what 400 pound? Worke, and finde

finde 53 ⅓ C weight of wooll. Now to finde the eſtate of their gaine, or loſſe, caſt vp his wooll at 6 li the C (for ſo much they were worth ready mony) and you ſhall finde 320 pound, which is 20 pound more then the ſilkes were to bee ſold for ready money, whereupon the Venetian gained 20 pounds by the Barter.

*A Merchant hath 53 ⅓ C waight of wooll at 6 pounds the C, to ſell for ready money, but in barter he will haue 7 pounds 10 ſ: and another doth barter with him for ſilkes, which are worth 3 pounds a peece ready money. The queſtion is now, how he ought to deliuer his ſilkes the peece in barter, and how many payeth for the wools.*

*Anſwer.* Say by the Rule of proportion, (or by the Rule of three direct) If 6 pounds for C waight ready mony yeeld me 7 li 10 ſ, what will 3 pound yeeld, which is the iuſt price of a peece of ſilke in barter, to make the Truck equall? Worke, and finde 3 li 15 ſ, the price of a peece of ſilke in barter: Then ſay, If 3 li 15 ſ require one peece of ſilke, how many peeces of ſilkes are bought with 400 pound, which is the value of the 53 ⅓ C waight of wooll at 7 li 10 ſ? Worke by the rule of three direct, and you ſhall finde 160 peeces of ſilke and ⅓ of a peece, and ſo many peeces of ſilke paye for the wooll, and neither party hath aduantage of other.

*Two men will change merchandize the one with the other. The one of them hath Beere at 6 ſ 8 d*

*the barrell to sell for ready mony, but in barter hee will sell the barrell for* 8 *s, and yet hee will gaine moreouer after* 10 *pound, vpon the* 100 *pounds. And the other hath white Spanish wooll at* 20 *s the Roue, to sell for ready mony. The question is now, how he shall deliuer the Roue of Wooll in barter to saue himselfe harmelesse.*

*Answer.* Say, If $6\frac{2}{3}$ *s*; which is the iust price of the barrell of beere, bee sold in barter for 8 shillings: for how much shall 20 shillings (which is the iust price of the Roue of Wooll be sold in barter? Worke by the rule of three direct, and you shall finde 24 *s*. Then for because the first Merchant will gaine after 10 pounds vpon the 100 pounds, he maketh his 100 pounds, 110 pounds. And therefore say by the rule of three, If the second Merchant of 110 pounds doe make but 100 pounds, how much shall he make of 24 *s*? Multiply and diuide, and you shall finde 21 *s*, $9\,d\,\frac{9}{11}$ of a penny. And for so much shall hee sell the Roue of wooll to be deliuered in barter, to the end the first Merchant may giue 10 in the 100.

*Two Merchants will change their commodities the one with the other. The one of them hath white Paper at* 4 *s the reame, to sell for ready money. And in barter he will do it away for* 5 *s, and yet he will gaine moreouer after the rate of* 10 *pounds vpon the* 100 *pounds. And the other hath Mace at* 14 *s* 6 *d the pound waight to sell in barter. Now I demand what the pound did cost in ready mony.* *Ans.*

*Answer.* Say, If 5 *l.* (which is the ouerprice of the Paper in barter) be come of 4 *l.* the iuſt price, of how much ſhall come 14 $\frac{1}{2}$ ſhillings, which is the ſurprife of the pound of Mace in barter? Multiply and diuide, and you ſhall find 11 $\frac{1}{5}$ *l.* Then for becauſe the firſt Merchant of Paper will gaine after 10. vpon the 100, Say, If 100 do giue 110, what ſhall 11 $\frac{1}{5}$ ſhillings giue? Worke, and you ſhall finde 12 *ſ.* — 9 $\frac{13}{25}$ *d.* and ſo much did the pound of Mace coſt in ready money.

## The fourteenth Chapter entreateth of exchanging of money from one place to the other.

*EXchange is no other thing, then to take or receiue money in one City, to render or pay the value thereof in another City, or elſe to giue money in one place, and receiue the value thereof in another, at terme of certaine dayes, moneths, or faires, according to the diuerſitie of the place.*

*But this practice chiefly conſiſteth in the knowledge of the money or Coynes in diuers places, of which for thy benefit (after a few examples giuen in the introduction of this worke) I will ſet downe certaine notes of the diuerſitie of the common and vſuall coynes in moſt places in Chriſtendome for traffique.*

And firſt I will begin at *Antwerpe*, where they vſe to make their accounts by *Deniers de groſſe*,

*grosse*, that is to say, pence Flemmish, whereof 12 do make 1 s. Flemmish, and 20 s. do make one pound *de grosse*.

*Item, a Merchant deliuered at* Antwerpe 400 *pounds Flemmish to receiue in* London 20 s *sterling, for euery* 23 s — 4 d *Flemmish: The question is now, how much sterling money is to bee receiued at* London *for the* 400 *pounds of Flemmish?*

*Answer.* Say by the rule of three, If 23 $\frac{1}{3}$ Flemmish giue 20 s sterling, what 400 pounds Flemmish? Worke, and you shall finde 342 li — 17 s — 1 $\frac{1}{7}$ pence, and so much sterling shall I receiue in *London* for the said 400 pounds Flemmish.

Otherwise also wrought by Rules of Practice in taking the $\frac{1}{7}$ of the Flemmish money deliuered, and abating the same from the principall, the rest is English money, as before.

400 li — 0 s — 0 d.
57 — 2 — 10 $\frac{2}{3}$

342 — 17 — 1 $\frac{1}{7}$ sterling.

*A Merchant at* London *deliuered* 200 li. *sterling for* Antwerpe, *at* 23 s — 5 d *Flemmish the pounds sterling. The question is, how much he must receiue at* Antwerpe.

*Answer.* Say by the Rule of three, if 1 pound sterling giue 25 s 5 d. Flemmish, what

200

200 li. ſterling? Worke, and you ſhall finde 234 li—3 ſ- 4 d. So many pounds Flemmiſh ſhall he receiue at *Antwerpe* for the ſaid 200 pounds ſterling.

Otherwiſe by practiſe.

| | | | |
|---|---|---|---|
| | 1 | 23—5 | 200 |
| 3 ſ-4 d | | | 33—6—8 |
| 1 d | | | —16—8 |
| maketh ſterling | | | 234 l-3 ſ—4 d. |

*In* London 20 *pound ſterling is deliuered by Exchange, for* Antwerpe, *at* 23 ſ. 9 d. *Flemmiſh the pound ſterling. The queſtion is, at what rate the Flemmiſh money ought to be returned to gaine* 4 *pounds vpon the* 100 *pound ſterling at* London.

*Anſwer.* Firſt ſay by the Rule of three direct: If 1 pound ſterling giue 23 $\frac{1}{4}$ Flemmiſh, what 200 pounds ſterling? Multiply and diuide, and you ſhall finde 237 pounds 10 ſhillings. The which to returne to gaine 8 pounds ſterling in *London*, ſay by the backer Rule, If 200 pounds ſterling require the exchange 23 ſ 9 d Flemmiſh, what the exchange to make 208 l ſterling? Worke by the Rule, and finde 22 ſ-10 $\frac{1}{8}$ d. Flemmiſh, the effect in the queſtion required.

*If I take vp money at* Antwerpe *after* 19 ſ 4 d *Flemmiſh, to pay for the ſame at* London 20

*ſhillings ſterling, and when the day of payment is come, I am forced to returne the ſame mony againe in* London, *to pay my Bill of Exchange: ſo that for* 20 *ſhillings which I take vp here at* London, *I muſt pay* 19 ſ. 6 d. *at* Antwerpe: *I demand whether I do winne or loſe, and how much in or vpon the* 100 *pounds of money?*

*Anſwer.* Say by the Rule of three: If $19\frac{1}{3}$ giue $19\frac{1}{3}$, what will 100 pounds giue? Multiply and diuide, and you ſhall finde 99 li. $2\frac{106}{117}$ ſ. which being abated from 10 pounds, there will remaine 17 ſhillings $\frac{11}{117}$, and ſo much I doe loſe vpon the 100 pounds of money.

*If I take vp at* London 20 *ſhillings ſterling, to pay at* Antwerpe 22 ſ 4 d. *and when the day of payment is come, my Factor is conſtrained to take vp money againe at* Antwerpe, *wherewith to pay the aforeſaid ſumme, and there he doth receiue* 23 ſ. 4 d. *Flemmiſh, for the which I muſt pay* 20 ſ *at* London: *The queſtion is now, whether I do winne or loſe, and how much vpon the* 100 li *of money after that rate.*

*Anſwer.* Say by the Rule of Proportion, If $22\frac{1}{3}$ ſ. giue $23\frac{1}{3}$ ſ. what will 100 pounds giue? Multiply and diuide, and you ſhall finde 104 pounds 9 ſhillings $\frac{27}{67}$, from the which abate 100 pounds, and there will remaine 4 pounds 9 ſhillings $\frac{27}{67}$, and ſo much is there gained vpon

on the 100 pounds of money.

*In* Antwerpe *is deliuered* 200 *pounds Flemmiſh by exchange for* London *at* 20 *ſhillings ſterling for euery* 23 *ſhillings* 4 d *Flemmiſh. The queſtion is, at what rate the ſame is to be returned to gaine* 10 *pounds vpon the* 100 *pounds Flemmiſh in* Antwerpe.

*Anſwer.* Firſt ſay by the Rule of three, if 23 $\frac{1}{3}$ Flemmiſh giue 20 ſ, what ſhall 200 pounds gaine? Worke, and you ſhall finde 171 pounds 8 ſ 6 $\frac{2}{3}$ d. Then ſay againe by the Rule of three direct, if 171 l—8 ſ—6 $\frac{2}{3}$ ſ ſterling giue me 210 pounds Flemmiſh, what ſhall 20 ſ ſterling giue? Worke, and you ſhall finde 24 ſ 6 d Flemmiſh. And at the ſame rate ought the ſame to be returned at *Antwerpe* to gaine 10 poũds vpon the 100 Flemmiſh.

*A Merchant of* Antwerpe *deliuereth* 234 *pound* 3 ſ 4 d *Flemmiſh, to receiue at* London 200 *pounds ſterling: The queſtion is now, how the exchange goeth after this rate?*

*Anſwer.* Say by the Rule of three direct, If 200 giue 20, what 234 $\frac{1}{2}$? Multiply and diuide, and you ſhall finde 23 ſ—5 d, And for ſo much goeth the exchange.

*Item, the exchange from* London *into* France, *is not like as it is in* Flanders, *but is deliuered by the French Crowne, which is worth* 50 *ſoulx Turnois the peece.*

Whereupon alſo you muſt note, that in

*France* they make their accounts by Franks, Soulx, and Deniers Turnois, whereof 12 Deniers make one Soulx Turnois, and 20 Soulx maketh 1 pound Turnois, which they call à Liure or Franke. But the Merchants, to make their accounts, do vse French Crownes, which is currant among them for 51 Soulx Turnois. But by exchange it is otherwise, for it is deliuered but for 50 Soulx Turnois the Crowne; or as the taker vp of the money can agree with the deliuerer. And note that this △ Character representeth the Crowne by exchange, and is euer 50 soulx Turnois or French mony.

*A Merchant deliuereth at* London 240 *pounds sterling, after* 5 *shillings* 6 *pence the crowne, to receiue at* Paris 50 *Soulx Turnois for euery Crowne. I demand how much Turnois or French money payeth the Bils for the said* 240 *pounds sterling.*

*Answer.* Say by the Rule of three, If 5 $\frac{1}{2}$ ſ sterling giue me 50 ſ Turnois, what shall 240 pounds sterling giue? Reduce the pounds into shillings, then multiply and diuide; and you shall finde 2181 Liures, 16 Soulx, 4 Deniers, and $\frac{4}{11}$ Turnois; and so much payeth the Bils at *Paris* for the 240 pounds sterling.

*A Merchant deliuereth at* Roan *or elsewhere in* France 1430 *pounds or francks, the which*

*francke*

*francke or pound is* 20 *ſoulx, or a pounds Turnois, to receiue in* London 6 ſ 4 d *ſterling for euery* △ *of* 50 *ſoulx Turnois. The queſtion is, how much ſterling mony I ought to receiue at* London *for my* 1430 *pound Turnois.*

*Anſwer.* Say if 2 $\frac{1}{3}$ pounds giue mee 6 $\frac{1}{3}$ ſ, what will 1430 giue me? Worke and you ſhall finde 3622 $\frac{2}{3}$ ſhillings ſterling, which maketh 181 pounds 2 ſ 8 d, and ſo much money is to be receiued at *London*, for the ſaid 1430 Liure Turnois, after 6 ſ 4 d for euery △ of 50 ſoulx.

*In* London *is deliuered* 200 *pound ſterling by exchange for* Paris, *at* 5 ſ 9 d *the* △ *of* 50 *ſoulx Turnois. The queſtion is, at what price the ſaid* △ *is to be returned to gaine* 6 *pounds vpon the* 100 *pound ſterling at* London?

*Anſwer.* Firſt ſay (by the Rule of three direct) if 5 $\frac{1}{4}$ ſ ſterling, giue 50 ſoulx Turnois, what ſhall 200 pound ſterling giue? Worke, and you ſhall finde 1739 franks or liures, 2 $\frac{14}{33}$, ſoulx. Then the which to returne and gaine 6 pounds vpon the 100 pounds in *London*, ſay by the rule of three direct, if 1739 franks 2 $\frac{14}{33}$ ſoulx yeeld 212 pounds, what the △ of 50 ſoulx? worke and finde 6 ſ 1 $\frac{7}{10}$ d, the effect required in the queſtion.

*A Merchant deliuered in* London 160 *pounds ſterling, to receiue in* Biskay *for euery* 5 ſ 6 d, *one Ducket of* 374 *Marauides. The queſtion is, how many Marauides ought I to receiue at Biskay?*

*Anſwer*

*Answer.* Say, if 5 ½ ſ ſterling giue 374 Maruides: what ſhall 160 pounds ſterling giue, Multiply and diuide, and you ſhall finde 217600 Maruides, and ſo many I ought to receiue at *Bukay* for my 160 pounds ſterling.

*A Merchant deliuered in* Baion 40000 *Maruides, to receiue in* London 5 ſ-8 d *ſterling for enery Ducket of* 374 *Maruides. The queſtion is now, how much ſterling mony payeth the Bils of Exchange for the ſaid* 40000 *Maruides?*

*Answer.* Say, if 374 Maruides make one Ducket, what 40000 Marurdes? Multiply and diuide, and finde 106 Duckets $\frac{178}{187}$.

Then ſay againe, if 1 Ducket giue 5 ½ ſ, what giueth 106 $\frac{178}{187}$ Duckets? Worke, and finde 30 li—6 ſ, $\frac{34}{161}$.

Otherwiſe it is wrought more briefe at one working, as in the laſt queſtion before, in conſidering that 5 ſ-8 d containeth one Ducket, or 374 Maruides. Therefore ſay by the Rule of three if 374 Marucides giue 5 ½ ſ, what 40000 Marucides? Worke, and you ſhall alſo finde in your quotient 30 li—6 $\frac{34}{161}$ ſ. And ſo many pounds ſterling is to be receiued for the 40000 Marucids

*In* London 200 *poũds deliuered by Exchange for* Vigo, 374 *Marucids the Ducket of* 5 ſ, 10 d *ſterling,*

*ſterling, maketh* 256457 $\frac{1}{7}$ *Marueides: the which to returne and gaine* 10 li. *vpon the* 100 *pounds in* London, *ſay by the Rule of three direct, if* 220 *pounds require* 256457 $\frac{1}{7}$ *Marueids, what* 5 *l.* 10 *d? Worke, and finde* 340 *Marueids, the price of euery Ducket in returne, which is the effect in the queſtion required.*

Theſe may ſeeme ſufficient for inſtructions.

*NOtwithſtanding for the further aid and benefit, hereafter follow ſix ſpeciall and moſt briefe Rules of Practiſe, for Engliſh, French, and Flemmiſh money.*

| | | |
|---|---|---|
| 1 | teacheth | How to turn Flem. to Eng. ſterling. |
| 2 | | How to turn Eng. ſterling to Flem. |
| 3 | | How to turn Flemmiſh to French. |
| 4 | | How to turn French into Flēmiſh. |
| 5 | | How to turn ſterling into French. |
| 6 | | How to turn French into ſterling. |

The

## The fifteenth Chapter intreateth of the said sixe Rules of Breuity, and of valuation of Englisch, Flemmisch, and French money, and how each of them may easily be brought to others value.

Rule 1. *How briefely to reduce pounds, shillings, and pence Flemmisch into pounds, shillings, and pence Englisch sterling.*

IT is to bee noted, that 7 pounds Flemmish maketh but 6 pounds sterling: 7 s. Flemish maketh 6 s. sterling, and 7 d. Flemmish 6 d. sterling: so that 7 yeeldeth but 6. Wherein is euident that then is lost $\frac{1}{7}$, (if it may be so called) when it is reduced into Englisch money: wherefore to know how much 233 l—13 s—4 d. Flemmish maketh Englisch, you must subtract from it $\frac{1}{7}$, beginning with the pounds, &c. and that which resteth after this subtraction, is the summe required: so that 233 li—13 s 4 d Flemmish, maketh 200 li—5 s—$8\frac{4}{7}$ d. sterling.

Example.

| | li | s | d |
|---|---|---|---|
| | 233 | 13 | 4 |
| $\frac{1}{7}$ | 33 | 7 | $7\frac{3}{7}$ |
| | 200 | 5 | $8\frac{4}{7}$ ster. |

Another example.

| | li | s | d |
|---|---|---|---|
| | 311 | 0 | 0 |
| $\frac{1}{7}$ | 44 | 8 | $6\frac{6}{7}$ |
| | 266 | 11 | $5\frac{1}{7}$ |

*To reduce pounds, ſhillings, and pence ſterling, into pounds, ſhillings, and pence Flemmiſh.* Rule 2.

Note that a pound ſterling maketh 1 li—3 ſ 4 d. Flemmiſh: that is, 1 $\frac{1}{6}$ li. 1 ſ ſterling maketh 1 $\frac{1}{6}$ ſ Flemmiſh, and 1 d. ſterling maketh 1 $\frac{1}{6}$ d. Flemmiſh. So that there is gained (if it may be ſo called) $\frac{1}{6}$ of the ſumme being thus reduced to Flemmiſh, for of $\frac{6}{6}$ is made $\frac{7}{6}$, which is one whole and $\frac{1}{6}$. Then to know how much 237 li—7 ſ—6 d. ſterling maketh Flemmiſh, ſubtract from your ſterling, the $\frac{1}{6}$ of the whole ſumme, and adde it to the ſame ſumme, and it maketh 276 li—18 ſ—4 d. which is the ſumme required.

| Example. | li. | ſ. | d |
|---|---|---|---|
| | 237 | 7 | 6 *ſter.* |
| $\frac{1}{6}$ | 39 | 11 | 3 |
| | 276 | 18 | 9 *Flem.* |

| Another Example. | li | ſ | d |
|---|---|---|---|
| | 337 | | |
| $\frac{1}{6}$ | 56 | 3 | 4 |
| | 393 | 3 | 4 |

*To reduce pounds, ſhillings, and pence Flemmiſh, into pounds, ſhillings, and pence French.* Rule 3.

Ye ſhall note, that the equality of Flemmiſh and French money is this, that is to ſay, the pound Flemmiſh, maketh 7 pound $\frac{1}{3}$ French, or Turnois. 1 ſ Flemmiſh maketh 7 $\frac{1}{3}$ ſ French and a groat Flemmiſh, maketh 7 $\frac{1}{3}$ d French.

Wherefore to know how much 143 li—4 ſ 9 d.

9 d. Flemmish maketh French, ye must multiply the whole number twice by 6, beginning at pence, and so forward, and the product of your second multiplication diuide by 5, so the worke is finished. Or multiply the said summe by 7, and take out of it $\frac{1}{7}$ adding it to the product of your multiplication by 7, and that is your number required. So that as well by the one as by the other, 143 li——4 s——9 d, Flemmish, maketh 1031 li——6 s——$2\frac{2}{3}$ d, French or Turnois.

Example.

| li | s | d | |
|---|---|---|---|
| 143 | 4 | 9 | *Flem.* |
| | | 6 | |
| 859 | 8 | 6 | |
| | | 6 | |
| 5156 | 11 | 0 | *Fren.* |
| $\frac{1}{5}$ 1031 | 6 | $2\frac{2}{3}$ | *Fren.* |

The same otherwise.

| li | s | d |
|---|---|---|
| 143 | 4 | 9 |
| | | 7 |
| 1002 | 13 | 3 |
| $\frac{1}{5}$ 28 | 12 | $11\frac{1}{7}$ |
| 1031 | 6 | $2\frac{2}{3}$ |

Another example.

143 l. *Flem.*

| | |
|---|---|
| 6 | |
| 858 | |
| 6 | |
| $\frac{1}{5}$ 5148 | |
| 1029 li $\frac{4}{5}$ *or* 12 s. | *Fren.* |

Or thus:

| | |
|---|---|
| 143 | |
| 7 | |
| 1001 | |
| $\frac{1}{7}$ 28 | 12 |
| 1029 li. | 12 |

*Fren.*

To

*To reduce pounds, ſhillings, and pence French, into pounds, ſhillings, and pence Flemmiſh.* Rule 4.

Multiply 233 li—8 ſ—4 d French by 5, and diuide the Product twice by 6, that is, the ſaid number by 6, and the product or quotient againe by 6, and the quotient of this ſecond Diuiſion is the thing required. So that 233 li-8 ſ-4 d French, maketh 32 li-8 ſ-4⅔ d Flemmiſh.

Example.

| li | ſ | d | |
|---|---|---|---|
| 233 | 8 | 4 | *Fren.* |
| | | 5 | |
| 1167 | 1 | 8 | |
| ⅙ 164 | 10 | 3⅔ | |
| ⅓ 32 | 8 | 4⅔ | *Flem.* |

Another.

| li | ſ | d | |
|---|---|---|---|
| 753 | | | *Fren.* |
| | | 5 | |
| 3765 | | | |
| ⅙ 627 | 10 | | |
| ⅙ 104 | 11 | 8 | *Flem.* |

*To reduce pounds, ſhillings and pence ſterling, into pounds, ſhillings, and pence, French, or Turnois.* Rule 5.

The pound ſterling maketh 8 l. 8 ſ, French that is to ſay, 8⅔ pounds: the ſhillings, maketh 8⅓ ſhillings, and the peny 8⅓ d French. Wherefore to know what 231 li—13 ſ—4 d ſterling maketh French, ye muſt multiply your whole ſumme by 42, that is, by 7, and the product of it by 6, and diuide this ſecond product by

by 5, and that is the summe required.

Otherwise, multiply the summe sterling by 8, and adde twice to the product $\frac{2}{7}$, and it shall produce the summe required. So that both wayes 231 li—13 s—4 d sterling, maketh 1946 li French, as hereunder followeth.

| | Example. | | | | The same otherwise. | | | |
|---|---|---|---|---|---|---|---|---|
| *Sterl.* | li | s | d | *ster.* | li | s | d | |
| | 231 | 13 | 4 | | 231 | 13 | 4 | |
| | | | 6 | | | | 8 | |
| | 1390 | 0 | 0 | | 1853 | 6 | 8 | |
| | | | 7 | | 46 | 6 | 8 | |
| | | | | | 46 | 6 | 8 | |
| | $\frac{2}{7}$ 9730 | 0 | 0 | | | | | |
| | | | | | 1946 | 0 | 0 | |
| *French.* | $\frac{2}{7}$ 1946 | 0 | 0 | *Fren.* | | | | |

| | Another example. | | | | The same. | | | |
|---|---|---|---|---|---|---|---|---|
| *Sterl.* | 753 | | | *Ster.* | 753 | | | |
| | 6 | | | | 8 | | | |
| | 4518 | | | | 6024 | | | |
| | 7 | | | | $\frac{2}{7}$ 150 | 12 | | |
| | 31626 | | | | $\frac{2}{7}$ 150 | 12 | | |
| *French.* | $\frac{2}{7}$ 6325 | | 4 | *Fren.* | 6325 | | 4 | |

*To reduce pounds, shillings, and pence, French, into pounds, shillings, and pence, sterling.*

To

To know how much 1256 li. 12 ſ. 6 d. *French* maketh in ſterling money: multiply the ſumme by 5, and diuide the product by 7 and 6 at twice, and the laſt quotient ſhall be the thing required, that is to ſay, 1256 li. 12 ſ. 6 d. maketh 149 pounds, 11 ſ. 11 $\frac{5}{7}$ d. ſterling. Rule 6.

| Example: | | | | Another Example: | | | |
|---|---|---|---|---|---|---|---|
| li | ſ | d | *French.* | li | ſ | d | |
| 1256 | 12 | 6 | | 2531 | 0 | 0 | *Fren.* |
| | | 5 | | | | 5 | |
| 6283 | 2 | 6 | | 12655 | | | |
| $\frac{1}{6}$ 1047 | 3 | 9 | | $\frac{1}{6}$ 2109 | 3 | 4 | |
| $\frac{1}{7}$ 149 | 11 | 11 $\frac{5}{7}$ | *Ster.* | $\frac{1}{7}$ 301 | 6 | 2 $\frac{5}{7}$ | *Ster.* |

Note, that when any money is giuen by exchange at *London* for *Roan* at 71 $\frac{1}{2}$ d. or rather 71 $\frac{1}{7}$ for the Crowne of 50 ſ. French, there is neither gaine nor loſſe: for it is one money for another, accounting 8 li—8 ſ. French, for one pound ſterling. So the giuer loſeth the time of paiment, which is about 15 dayes, and he that taketh it, hath the gaine of the ſame.

They of *Roan* that put forth or take money by exchange for *London*, ought to haue like conſideration.

*Item*, when any man glueth at *London* 64 pence $\frac{1}{7}$, or rather 64 $\frac{5}{7}$ d. to haue at one of the Fayres of *Lyons* a Crowne *de Marc*, hee

that ſo giueth the money, loſeth the time, and he hath taketh it, gaineth the ſame: for 62 pence ½ is equall in value to 45 ſ French. He that putteth or taketh money at *Lyons* for *London*, ought to conſider the ſame.

*Item*, when any deliuer in *Antwerpe* 75 pence, to receiue at *Lyons* a Crowne *de Marc*, he that putteth it forth, loſeth the time, and he that taketh it, gaineth the ſame. For 75 groates Flemmiſh, is equall in value to 45 ſ French.

*Thus for this time I make an end of the practiſe of Exchange, and the inſtructions thereunto belonging, and according to my promiſe: yet further to gratifie ſuch as are deſirous to know the common Coynes vſed for trafficke among Merchants in theſe Cities following, a briefe declaration of their Moneyes, and the reckonings, and account of them.*

The

## The sixteenth Chapter containeth a declaration of the valuation and diuersitie of Coynes of most places of Christendome for trafficke; And the manner of exchange in those places from one Citie or Towne to another: which knowne, is right necessarie for Merchants, by meanes whereof they do finde the gaine or losse vpon the exchange.

*Item*, for as much as the greatest diuersitie of money of exchange is at *Lyons*: therefore I will begin duely of the money of that place.

At *Lyons* they vse Franckes, Soulx, and deniers Tournois. A Franke maketh 20 Soulx, and one Soulx 12 Deniers. But the Merchants to keepe their bookes of accounts, doe vse French Crowns of the Marke at 45 Soulx the peece, and do diuide it into 20 Soulx, 1 Soulx is 12 Deniers.

*Item*, a Marke of Gold maketh 65 Δ of the Marke, which serueth for exchange, and diuide it into 8 ounces. The ounce into 24 pence or deniers, the denier into 24 graines, and so the summe or whole by imagination or gesse.

Δ This Marke standeth for a Crowne.

Also at *Lyons* there are 4 Faires in a yeare, at the which they do commonly exchange, which are from three monethe to 3 monethe.

At *Geanes* they vſe the Soulx: one Ducket maketh 3 pound.

At *Naples* they vſe Duckets, Taries, and Graines, the Ducket maketh 5 Taries, and one Tarie 20 Graines: but they take 6 Duckets (which maketh thirtie Taries) for the ounce.

A Ducket maketh ten Carlins, and a Carlin ten Graines, ſo that 2 Carlins make a Tarie, and 100 Graines make a Ducket.

At *Rome* they vſe the Duckets of the Chamber: one Ducket is worth 12 Guilis, and one Guilis 10 Soulx.

At *Venice* they vſe Duckets currant at 124 ſoulx a peece, or 24 Deniers, and one Denier maketh 32 Picolis.

At *Palerme* and *Meſſine* they write, after ounce, tarie, and graines, and one ounce is worth 6 Duckets of 30 taries. and 1 tarie is 20 graines, and 1 graine 6 Picolis, 1 ducket is alſo worth 24 Carlins.

At *Millan* they vſe li. ſ. d. of ducket Imperials, and △ of exchange is worth 4 li.

At *Lucques*, *Florence*, and *Ancone*, they vſe the △ of Gold: in Gold the French Crowne is worth 7 li. but at *Boloigne* 3 li. 10 ſ.

At *Barcelone* they vſe the Soulx: the ducket of exchange is worth 22 Soulx.

At *Valence* and *Saragoſſe* they vſe the Liuer, Soulx, and Denier: the French Crowne of exchange is worth 20 Soulx, and one Soulx is twelue Deniers.

At

At the Faires of *Caſtill* they vſe the Marueides, the Ducket is worth 375 Marueides.

At *Lisbone* they vſe the Raies, one Ducket of exchange is worth 400 Rayes.

At *Noremburge*, *Franckeford*, and *Auguſt* in *Germany*, they vſe the *Krentzars*, whereof 60 make a Floren.

At *Antwerpe* they vſe li—ſ. and d. de Gros and they exchange into the denier de Gros, to wit, our Engliſh peny.

At *London* they vſe the li. the ſ. and d. ſterling, and they exchange in pence ſterling.

*The exchange of Lyons at ſundry places.*

*Item*, at *Lyons* there is exchange in three ſorts, at the Cities and Townes following.

Firſt, they deliuer at *Lyons* one Marke to haue or receiue at *Naples* almoſt 41 $\frac{1}{2}$ Duckets, at *Venice* 70 Duckets currant: at *Rome* 63 Duckets of the Chamber: at *Lucques* and *Florence* 65 △ of gold at *Millan* 82 △.

And contrariwiſe, at the ſaid Cities aforeſaid, they do giue ſo much of money, to haue a Marke at *Lyons*.

Secondly, they giue at *Lisbone* one △ of Marke of 45 ſoulx Turnois a peece, to haue at *Geanes* almoſt 68 ſoulx, at *Palerme* and *Meſſine* almoſt 24 Carlins, at *Barſelone* 22 ſoulx, at *Valence* or *Saragoſſe* 20 ſoulx, at the Faire at *Caſtill* 350 Marueides, at *Lisbone* 360 *Rayes*, in *Antwerpe* 57 Deniers *de Gros*, and at *London* 70 d ſterling.

And contrariwise, they giue in the said Cities almost as much of their money to haue a French Crowne of the Marke at *Lyons*.

Thirdly, they do giue at *Lyons* a △ of the Sunne, to haue almost 93 *Krentzars* at *Franckford*, *Augsburge*, *Noremberge*, or other Cities in *Almaine*.

Also at *Lyons* only they do pay they change the $\frac{2}{3}$ in Gold, and $\frac{1}{3}$ in Money, or else all in Money, in giuing 1 $\frac{1}{3}$ for the hundreth.

*Changes at Naples and other Townes.*

Item, at *Naples* they giue or deliuer almost 112 Duckets, to receiue at *Rome* 100 Duckets of the Chamber at the old value.

Through *Lucques* and *Florence* they deliuer 100 Duckets Carlins, to receiue there almost 86 △ of Gold.

Through *Palerme* and *Messine*, one Ducket of 5 Tary, to receiue there almost 164 grains.

Through *Millan*, one Ducket, to receiue there almost 90 Soulx.

Through *Geans* one Ducket to receiue there almost 65 soulx The whole summe to be paid within ten dayes after the sight of the Bill of Exchange.

Also at *Naples* they deliuer one Ducket to receiue in *Antwerpe* almost 67 d. or Deniers *de Gros*, within two moneths. At *London* almost 60 d. sterling in three moneths. At *Barselone* almost 20 soulx within two moneths.

At

At *Valence* almoſt 18 Soulx within two moneths. At *Lisbone* 333 Rayes within three moneths: and at the Faire at *Caſtill*, almoſt 340 Marueides at the ſame Faire.

*Change of Venice to other places.*

At *Venice* they deliuer 100 Duckets currant to receiue in *Almaine* almoſt 140 *Florens* at 60 *Krentzers* the peece.

At *Lucques* and *Florence* almoſt 108 ∆ of Gold in 10 dayes.

Likewiſe at *Venice* they deliuer a Ducket currant to receiue at *Palerme* and *Meſſine* almoſt 21 Carlins, at *Millan* almoſt 93 Soulx, at *Geanes* almoſt 62 Soulx, the whole at ten dayes end.

*Of the Pair or Pari.*

As touching the Exchange, it is neceſſary to vnderſtand or know the *Pair*, which the Italians call *Pari*, which is no other thing then to make the money of the change of one Citie or Towne, to or with the money of another, by meanes whereof they doe finde the gaines or loſſe vpon the Exchange.

*Example.*

Item, hauing receiued letters of credit of one of *Antwerpe*, that the ∆ of the Sunne is there worth 7 ſoulx: The queſtion is, what the ſame is worth at *London*, when the *Pair* of Exchange goeth for 23 ſhillings?

Anſwer. *Say, if* 23 *giue but* 20, *what giueth* 7? *Worke, and finde* 6 l. 1 $\frac{1}{13}$ d. *and ſo much is the* △ *of the Sunne worth at* London.

## The ſeuenteenth Chapter containeth *alſo a declaration of the diuerſitie of the weights and meaſures of moſt places of Chriſtendome for traffique. At the end of which diſcourſe are two Tables, the one for weight, and the other for meaſure, proportionate and reduced to an equality of our Engliſh meaſure and weight, by the aid whereof, the ingenious may eaſily by the Rule of three, conuert the one into the other at pleaſure, &c.*

AT *London*, and ſo all *England* thorow, are vſed two kinds of weights and meaſures, as the *Troy* weight, and the *Haberdepoiſe*. From the *Troy* weight is deriued the proportion and quantitie of all kinde of drie and liquid meaſures, as pecks, buſhels, quarters, &c. wherewith is bought and ſold all kinde of graine and other commodities met by the Buſh. And in liquid, ale, beere, wine, oyle, butter, hony, &c. vpon theſe grounds & ſtatutes is bread made, and ſold by the *Troy* weight: and ſo is gold, ſiluer, pearle, precious ſtones, and Iewels. The leaſt quantity of this *Troy* weight is a graine: 24 of theſe graines make a peny-weight, 20 peny weights an ounce, and

12 ounces a pound, 2 pounds or pintes of this weight maketh a quart. And ſo aſcending into bigger quantities, is produced the meaſures whereby are ſold our other naturall ſuſtenance: *viz.* Ale or Beere, with all other neceſſarie commodities, as Butter, Hony, Herrings, Eeles, Sope, &c. All which laſt before rehearſed, though their meaſures (wherein they are contained) be framed and deriued from the *Troy weight*, yet are they in traffique with diuers commodities, as Lead, Tinne, Flax, Wax, with all other commodities both of this Realme, and of other forraigne Countries whatſoeuer, bought and ſold by the *Haberdepoiſe weight* after ſixteene ounces to the pound, and 112 pound to the C. weight. And to euery C. is alloweed but 12 pound weight at the common beame. From hence is alſo deriued the weight of *Suffolke* Cheeſe, which containeth 32 cloues, 8 pound to a cloue, and weigheth in all 256 pounds. And alſo the Barrell of *Suffolke* Butter is, or ſhould be of like weight with the weight of Cheeſe, *viz.* 256 pounds. More 14 of theſe pounds make a Stone, and 26 Stone containeth a Sack of Engliſh wooll, Forraigne woools; to wit, French, Spaniſh, and Eſtrich, is alſo ſold by the pound or C. weight, but moſt commonly by the Roue, 25 pound to a Roue: other commodities of Tale, are bought and ſold by the C. fiue ſcore to the C. Except headed ware, to wit,

See further of theſe Weights & Meaſures in Reduction, beginning page 133.

wit, Cattell, Nayles, and Fish, which are sold after sixscore to the C. There are also two other sorts of measures, to wit, the Ell and the Yard. By the Ell is vsually met, Linnen cloth, as Canuas, &c. And by the yard, Silkes, woollen clothes, &c.

*Antwerpe.*

At *Antwerpe* are also 2 sorts of weights, their gold and siluer weight, and their common weight. Gold and siluer is weighed by the *Marke*, the *Marke* is 8 ounces, the ounce 20 Esterlings, and the Esterling 32, as our graines. The Goldsmiths diuide that into smaller, but not the Merchants: The proofe of gold is made by Karects, whereof 24 maketh a marke of fine gold, the Karect is 24 graines: the proofe of the money is made by *Deniers*: 12 deniers is 1 s. fine, that is a *marke* of fine siluer; the denier also is diuided into 24 graines, and the graine into 4 quarters.

*Item*, 100 *Marks in* Antwerpe, Troy *weight, maketh at* Lyons 103 *Markes*, 2 $\frac{1}{2}$ *ounces, and* 20 *graines*, 23 *p. At* Noremberg 103 *marks* 2 $\frac{1}{2}$ *ounces*, 2 *quints*, 3 *Deniers*; *at* Franckford, 105 *marks*; *at* Augsburg 104 *markes, three ounces*, 1 *quint. At* Venice 103 *marks*; 1 *ounce*, 7 *deniers*, 18 *Graines. At* London 66 *pounds.*

*The mark of gold or siluer at* Antwerpe, Troy *weight, which is* 8 *ounces, maketh* 7 $\frac{1}{2}$ *ounces common weight, with which all other merchandise*

*dise is weighed. So that the* Troy *weight is greater then the common weight by* 6 $\frac{1}{2}$ *in the C. By this weight of* Troy, *they also weigh* Muske, Amber, Pearle, *&c.*

*All Silkes are bought at* Antwerpe, *by the* Burges Ell, *which is greater then the common measure, by which they retaile by two in the hundred. Their common Ell is* $\frac{3}{4}$ *of our yard, and* $\frac{3}{5}$ *of our Ell.*

*Lyons.*

At *Lyons* is vsed 3 sorts of weight, whereof the first is the common Towne weight, with which they weigh all kinde of *Spicery*, and diuers other merchandise. The second is called *Geneua* weight, which is 8 in the C greater then the common weight, with which they weigh Silkes, &c. The third is French weight, called commonly the *Marke weight*, and 100 pounds thereof maketh 106 $\frac{1}{4}$ li. *Geneua*, and 114 $\frac{3}{4}$ of their common weight: with which French weight, is weighed all things that payed custome or toll.

At *Lyons* is also vsed two sorts of Ells or *Aulnes*. The one wherewith they measure grosse clothes, as canuas, and such like. The other is called the French Ell or *Aulne*, with which they measure all other kinde of merchandise, whereof seuen common towne Ells maketh 11 ordinary French Ells.

*Roan.*

At *Roan* 6 $\frac{1}{3}$ Muides of salt, being the measure

ſure of the place, make a C. at *Armuiden* in *Zeland*, and the C. of *Bronage* meaſure of *Armuiden*, maketh at *Roan* 11. Muides, 30 Muides make a laſt of corne, and 16 a laſt of Oates, 100 pound weight there, maketh at *London* 114 $\frac{1}{4}$, and 190 $\frac{1}{4}$ at *Antwerpe*. And 100 ells make at *London* 115 $\frac{1}{4}$.

*Noremburge.*

A 100 pound weight at *Noremburge* maketh at *London* 111 $\frac{1}{4}$. at *Antwerpe* 107 $\frac{1}{2}$, and 100 ells at *Noremburge* make at *London* 75 $\frac{2}{3}$ at *Antwerpe* 95 $\frac{1}{2}$, &c.

*Liſbone.*

The C weight at *Liſbone* maketh foure Roues, euery Roue 32 pounds: ſo that their C. weight is 128 pounds, and their pound containeth 14 ounces, and 100 pounds of their weight maketh at *London* 113 $\frac{1}{2}$.

Their Silke, cloth of God, and Woollen is meaſured with a meaſure which they call a cubite, containing about $\frac{3}{4}$ of a Varre of *Caſtile*. Howbeit, their common meaſure is called a Varre, which maketh 5 Palmes, and containeth 1 $\frac{1}{4}$ of a Varre of *Caſtile*, our Ell of *London* is equall with the Varre of *Liſbone*.

All kinde of Merchandize brought from *Flanders*, *Roan*, or *Brittaine*, payeth at *Liſbone*, as a dutie or cuſtome to the King, 20 in the C. which they call the tenth in Merchandiſe,

and

and the other tenth in money.

Note also, that all kinde of Merchandize comming to *Lisbone* by Land, payeth lesse in custome, then that that commeth by water.

*Civill.*

The Roue of *Civill* is 30 pound, 4 Roues make their C weight, which is 120 pounds. The 100 pounds of *Civill* maketh at *London* 102 pounds. Their other common measure is a Varre, whereof 100 maketh at *London* 74 Ells, and at *Rome* 40 Canes, &c.

*Venice.*

At *Venice* bee two sorts of weight, the one called *La Grosse*, the other *La Suttle*. with the grosse is weighed all kinde of great wares; and with the small all kinde of spicery, and such like: 96 pounds of grosse weight there, maketh at *London* 100 pound, and 100 pounds of spicerie there without any tare or allowance, make at *London* 94, and with tare 65.

Their owne common measure are Braces, whereof 100 make at *London* 55 ½ Ells, at *Antwerpe* 92 ½, &c.

*Florence.*

At *Florence* the 100 li. weight maketh at *Aquila*, for Saffron 110, and 145 pounds of *Florence*, make at *Roan* but 100 pounds, the weight of *Florence* and that of *Luke* is all one.

Their

Their other measures are Braces, whereof 100 maketh at *Antwerp Burges* measure, 81 ⅓ Ells, 100 Braces there, make at *London* 49 Ells, &c.

*Lucque.*

The *Lucque* Sattens are commonly sold at *Lyons* by weight, and 133 ⅓ pounds maketh at *Lyons* 100 pound, so that 1 pound ⅓ maketh at *Lyons* but one pound.

Their other measures are Braces, whereof 100 of them make at *London* 50 Ells, at *Antwerpe* 83 ⅓ Ells, &c.

*Aquila.*

At *Aquila* their 100 pounds maketh at *London* 71 ¼, their 136 ⅔ pounds of Saffron maketh at *Geneua* but 100, and 11 li of *Geneua* maketh 15 li: at *Aquila.*

*Valentia.*

At *Valentia* be 2 sorts of weights, a great and a small. The C weight or great weight containeth 4 Roues, the Roue 36 li. so the C. great weight is 144 li. and the C. weight small containeth but 120 pounds, and is also parted into 4 Roues, which is 30 pounds to a Roue. By the small is sold the scarlet graine, with all other kind of spicery, and by the great is sold woolle, withall such like grosse wares. The 1 ⅓ pounds of silke at *Valentia*, maketh at *Lyons* one pound *Geneua* weight. The charge of great Merchandize at *Valentia* containeth

432 pound, an in small wares 360 pounds. The weight here and at *Barsellone* is all one. Their 100 pound weight maketh at *London* 78 pound, at *Antwerpe* 75.

*Dansicke.*

At *Dansicke* or *Spruce land* the rule is, that whosoeuer buyeth any Merchandize there, buyeth it by the ship-pound, which is 320 li. 20 Lispounds make a Ship pound, and the Lispound containeth 16 pound, which Ship-pound of *Dansicke* maketh at *Antwerpe* 266 $\frac{2}{3}$ li. Their 100 li weight, maketh at *London* 86 $\frac{1}{2}$ &c.

Their other common measures are Elles, whereof 100 maketh at *London* 72 $\frac{1}{4}$ and at *Antwerpe* 820 $\frac{1}{3}$ Ells.

*Toulhouse.*

At *Toulhouse* 6 Cabes of woad maketh a Charge, two Cesternes of Corne-measure, and all kind of graine maketh a Charge, the Cesterne weigheth 160 li weight of that place. Their 100 in weight, maketh at *London* but 91 $\frac{1}{4}$ pound,

*Geanes.*

At *Genua* or *Geanes*, 100 li of their weight maketh at *London* 71 $\frac{1}{2}$, and at *Antwerpe* 68 $\frac{3}{8}$ 100 li weight at *Genua*, maketh at *Venice*, to wit, Suttle 106 li.

Their other common Measures are *Palmes*, whereof 100 make at *London* 20 $\frac{3}{4}$ Ells: and at *Antwerpe* 34 $\frac{3}{4}$.

*The*

*The reſt are ſupplied in two Tables, which hereafter followeth: whereby the ingenious may gather his deſire.*

The Table of the agreement of the weights of diuers Countries, the one with the other, being reduced to an equality, as followeth.

112 pounds is weight at *London* make at

| | |
|---|---|
| *Antwerpe.* | 107 1/7 |
| *Franckeford.* | 099 |
| *Collen and Ausburg.* | 102 1/2 |
| *Noremburg.* | 100 1/4 |
| *Roan.* | 098 |
| *Paris.* | 102 1/4 |
| *Lyons.* | 118 1/3 |
| *Diepe.* | 100 1/4 |
| *Geneua.* | 090 1/3 |
| *Tewlouſe.* | 122 1/4 |
| *Rochel.* | 124 1/4 |
| *Marcellis.* | 124 1/4 |
| *Ciuill, &c.* | 109 1/4 |

112 pounds weight at *London*, make at

| | |
|---|---|
| *Venice groſſe weight.* | 105 1/8 |
| *Venice ſubtile weight.* | 166 1/7 |
| *Aquila.* | 157 1/7 |
| *Vienna.* | 089 1/3 |
| *Preſlaw.* | 134 1/2 |
| *Leipſig.* | 101 1/4 |
| *Danſicke.* | 129 1/4 |
| *Lubecke.* | 097 1/2 |
| *Barcellon.* | 144 1/2 |
| *Liſbon.* | 099 |
| *Geanes.* | 157 1/7 |

The

The other Table of agreement of Measures of diuers Coūtries reduced vnto an equality, by the aide whereof you may with the vse of the Rule of three, conuert either more or lesse of any one measure vnto the other.

60 Ells, or 7 Yards at *London* make at

| | | |
|---|---|---|
| *Antwerpe* | 100 | |
| *Norenburg* | 104 1/2 | *Ells.* |
| *Franckford* | 125 | |
| *Leipsig* | 125 | |
| *Preslaw* | 125 | |
| *Dansicke* | 183 | |
| *Vienne in Austria* | 87 | |
| *Lyons in France* | 60 1/2 | *Aulnes.* |
| *Paris in France* | 57 | |
| *Roan in Normandy* | 52 | |
| *Lisbone* | 60 | *Varres.* |
| *Ciuill in Spaine* | 81 | |
| *Castile in Spaine* | 81 | |
| *Methera Iles* | 62 | |
| *Venice* | 108 | *Braces.* |
| *Lucques* | 120 | |
| *Florence* | 122 1/3 | |
| *Millane* | 138 | |
| *Rome* | 90 | *Canes.* |
| *Geanes* | 288 6/13 | *Palmes* |

## The eighteenth Chapter treateth of Sports and Pastimes, done by Number.

IF you would know the number that any man doth thinke or imagine in his minde, as though you could diuine, bid them triple it, or put twice so much more to it as it is, which done, aske him whether it be euen or odde: if he say odde, bid him take one to it, to make it euen, and for that one keepe one in your minde. Now after he hath taken one to it, to make it euen, bid him giue away halfe, and keepe the other halfe for himselfe, which when he hath done, bid him triple that halfe, and againe after he hath tripled it, aske him whether it be euen or odde: if hee say odde, then bid him take one to make it euen again, & for that last one, keepe two in your minde: now after hee hath made his number euen, bid him cast away the one halfe, and keepe the other stil, from which halfe that he keepeth cause him subtilly to put away or giue you 9 out of his number, as oft as he can and for each 9 that he giueth you, keepe, 4 in your minde, and thereunto ioyne the 3 which I bade you keepe, and you shall haue your desire.

Example.

*Imagine hee thought 7, the triple whereof is*

*21, and becauſe it is odde, he is to take 1 to make it euen, which firſt 1 giuen, is for you to keepe in minde. Then the halfe of his 22 being caſt away, he reſerueth ſtill 11, which after you haue bid him triple, it maketh 33: then in giuing of him one againe to make it euen, vpon that laſt 1 reſerue 2 in your minde, then his halfe of 34 maketh 17; from whence he can giue you 9 but once. Therefore that yeelding to you 4, and the 3 that you keep, make 7, your deſire.*

Another kinde of Diuination, to tell your friend how many pence or ſingle peeces, reckoning them one with another, hee hath in his purſe, or ſhould thinke in his minde.

*Which to do, firſt bid him double the peeces he hath in his purſe, or the number he thinketh (if he participate his number or ſecreſie vnto ſome one friend that ſitteth by him that can but multiply, and adde neuer ſo little: if their number be great, then ſhall they worke as you bid them ſo much the ſurer.)*

Now after hee hath doubled his number, bid him adde thereunto 5 more, which done, bid him multiply that his number by 5 alſo: which done, bid him tell you the iuſt ſumme of his laſt multiplication, which ſumme the giuer thinketh it nothing auailable, becauſe it is ſo great aboue his pretended imagination: yet thereby ſhall you preſently with the helpe of Subtraction tell his propoſed number.

The Rule is this.

*Imagine he thought 17, Double 17, and it maketh 34, whereunto if you adde 5, it maketh 39: which multiplyed by 5, as here is practiſed, it yeeldeth 195, which 195 is the ſumme deliuered you in the worke: then for a generall Rule you ſhall euermore cut off the laſt figure toward your right hand, with a daſh of your pen, as here is performed, as a figure nothing auaileable vnto your worke, and then rebate 2 from your firſt figure, after 5 is cut off, and the reſt ſhall euermore be your deſire, as by this example doth appeare.*

| | |
|---|---|
| | 17 |
| | 2 |
| | 34 |
| | 5 |
| | 39 |
| | 5 |
| | 195 |
| | 2 |
| | 17 |

*Another of a Ring.*

If in any company you are diſpoſed to make them merry by manner of diuining, in deliuering a Ring vnto any one of them, which after you haue deliuered it vnto them, that you will abſent your ſelfe from them, and they to deuiſe after you are gone, which of them ſhall haue the keeping thereof, and that you at your returne will tell them what perſon hath it, vpon what hand, vpon what finger, and what ioynt: Which to do, cauſe the perſons to ſit downe all in a row, and to keepe likewiſe an order of their fingers: now, after ye are gone out from them to ſome other place, ſay vnto one of the lookers on, that he double the numbers of him that hath the

Ring

Ring, and vnto the double bid him adde 5, and then cause him to multiply the Addition by 5, and vnto the product, bid him adde the number of the finger of the person that hath the Ring. And lastly, to end the work, beyond that number towards his right hand, let him set downe a figure signifying vpon which of the ioynts he hath the Ring, as if it bee vpon the second ioynt let him put downe 2. Then demand of him what number hee keepeth, from the which you shall abate 250, and you shall haue three figures remaining at the least. The first toward your left hand, shall signifie the number of the person which hath the Ring, the second or middle number shall declare the number of the finger, and the last figure towards your right hand shall betoken the number of the ioynt.

## Example.

*Imagine the seuenth person is determined to keepe the Ring vpon the fifth finger, and the third ioynt: first double 7, it maketh 14, thereto adde 5, it maketh 19, which multiplyed by 5, yeeldeth 95, vnto which 95, adde the number of the finger, and it maketh 100: and beyond 100 toward the right hand, I set downe 3 the number of the ioynt, all maketh 1003, which is the number that is to bee deliuered you, from which abating 205, there resteth 753, which prefigureth vnto you the seuenth person,*

*the fifth figure, and the third ioynt.*

*But note, that when you haue made your subtraction, if there do remaine 0, in the place of tens, that is to say, in the second place, you must then abate 1, from the figure which is in the place of the hundreds, that is to wit, from the figure which is next your left hand, and that shall bee worth 10 tenths, signifying the tenth finger, as if there should remaine 803, you must say, that the seuenth person vpon his tenth finger, and vpon his third ioynt, hath the Ring.*

## Another of three Dice.

If a man do cast 3 Dice, you may know the points of one of euery of them. For if you cause him to double the points of one Die, & to the double to adde 5, and the same summe to multiply by 5, and vnto the product adde the points of one of the other Dice; and behinde the number towards the right hand, to put the figure which signifieth the points of the last Die, and then to aske what number he keepeth, from which abate 250, and there will remaine 3 figures, which do note vnto you the points of euery Die.

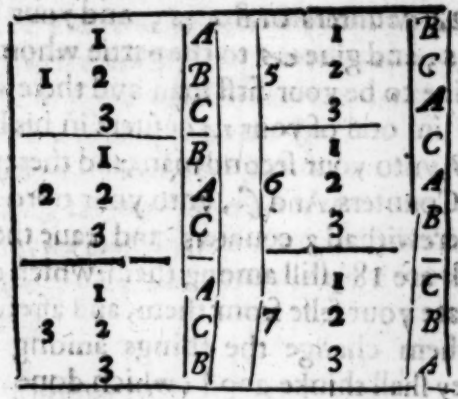
## *Another of things hidden.*

If three diuers things are to bee hidden of three diuers persons, and you to diuine, which of the three persons hath the three diuers things, do thus: Imagine the three things to be represented *A, B, C.* Then secondly keepe

well

well in your minde which of the persons you meane to be the first, second, and third. Then take 24 counters or stones, and your three things, and giue *A* to the partie whom you imagine to be your first man, and therewithal giue him one of your 24 counters in his hand, and *B*, vnto your second man, and therewithall 2 Counters. And *C*, vnto your third man, & therewithall 3 counters: and leaue the rest, which are 18, still among them: which done, separate your selfe from them, and afterwards bid them change the things among them as they shall thinke good: which done, after they are agreed, bid him that hath such a thing, as before you haue represented by *A*, for euery counter that he hath in his hand, to take vp as many more. And for him that hath *B*. For euery one in his hand to take vp two. And for him that hath *C*, for euery one in his hand to take vp 4, and the rest of them to leaue still vpon the board. These 3 things and the three persons being fully printed in your minde, come to the Table, & you shall euermore finde one of these 6 numbers, 1, 2, 3, 4, 5, 6, or 7. If therefore one remaine still vpon the board, then haue they made no exchange, but keepe them still as they were deliuered vnto them. So that the first man hath *A*, the second *B*, and the third *C*. But if 2 remaine, then the first man hath *B*, your second man *A*, and your third man *C*. The rest of the worke and the order thereof are

here apparant by the Table following.



| | | | | | |
|---|---|---|---|---|---|
| | 1 | A | | 1 | B |
| 1 | 2 | B | 5 | 2 | C |
| | 3 | C | | 3 | A |
| | 1 | B | | 1 | C |
| 2 | 2 | A | 6 | 2 | A |
| | 3 | C | | 3 | B |
| | 1 | A | | 1 | C |
| 3 | 2 | C | 7 | 2 | B |
| | 3 | B | | 3 | A |

*Another divination of a number vpon the casting of two Dice.*

First let the Caster cast both the Dice, and marke well the number; then let him take vp one of them, it maketh no matter which, and looke what number it hath in the bottome, and adde all together: then cast the Dye againe, and keepe in his minde what all together maketh: then let the Dice stand, and bring seuen with you, and thereunto adde the rest of the pits that you see vpon the vpper side of the Dice, and so many did the caster cast in all.

FINIS.

# An Appendix concerning the Resolution of the *Square* and *Cube* in numbers, to the finding of their *side* By Ro. Hartwell.

*A Figurate number is a number made by the multiplicatio of one number or more by another.* A figurate number, what.

*The sides of a figurate number, are the numbers by whose multiplication it is made.* The sides of a figurate number, what.

*A Figurate number is two-fold, a* { *Plaine.* / *Solid.*

*And it is* { *Of one multiplication,* / *Or consequently of many,* } *as a* { *Plaine.* / *Solid.*

*And in each* { *Both Equilater.* / *And Inequilater.*

*A figurate number made of one multiplication, by two sides or numbers multiplied together, it called a plaine figurate number.*

For euery number made by the mutuall multiplication of two numbers, may bee called a *Plaine*, becausc it bringeth forth a right-angled parallelogramme; according to his vnites disposed in *length* and *breadth*, the *sides* whereof are the two multiplying numbers. As the number 20, made by the mutuall multiplication of 4 and 5 A plaine figurate number.

is called a *Plaine*, and the *sides* thereof are 4 and 5 as here.

* * * * *
* * * * *
* * * * *
* * * * *

Because the vnities thereof disposed in *length* and *breadth*, as the *sides* doe expresse, doe bring forth an *inequilater Parallelogramme*, for that the numbers, or *sides* are inequall.

By like reason 36 made by multiplication of 6 by 6, is called an *equilater plaine*, for the *sides* thereof 6 and 6 are equall.

Moreouer, one and the same *plaine number* may haue many *sides*, as the *plaine number* 24. hath sides 4 and sixe: 3 and eight: 2 and 12 For it is produced from the mutuall multiplication of these numbers: whereupon for the inuention of the sides, to wit, in *inequilater Plaines*, it is needfull to giue one of the *sides*, by which the *plaine* it selfe diuided, the other *side* is made knowne. As the *plaine* 48 being diuided by the *side* 8, the *quotient* 6 is the remaining *side*. Notwithstanding another resolution and inquisition doth happen in the *sides* of the *aequilater plaines*.

An equilater Plaine or quadrat what.

*An aequilater plaine is a number made by two equall sides, or by any number multiplyed by it selfe. It is vulgarly called a square or quadrat: by the Arabians* Zensus, *it is commonly expressed by this note* 3. *by vs* q.

*A quadrat* or *square* in *Geometrie* is called a right lined *plaine figure*, made by foure equall right lines, and so many right angles, & euery one of the lines it called the *side* of the *quadrat*

as

is this *Figure a b c d* whose *side* is *a b*, or *b c*, *a* is also *c d*, and *a d*.



To the similitude hereof, that number is called a *Quadrat*, which is made, by the multiplication of two equall numbers, or of one in it selfe of which manner 36 is made, by 6 multiplyed in it selfe, or by the mutuall multiplication of 6 and 6. For if 36 vnites bee placed in plaine forme, it bringeth forth a perfect *Geometricall Quadrat* having in euery side sixe vnities as here.

*The number whereof the Quadrat is produced by multiplication in it selfe, is called the side or root of the Quadrat.*

The side or root of a number what.

## Concerning the extraction of the *quadrat or square Root.*

THerefore to finde the *quadrat root*, or the *side* of any *quadrat number*, is to search a number, which brought or multiplyed in it selfe, maketh the number propounded: concerning the finding whereof, as it is requisite that the *sides* (being lesser then 10) of the *squares* vnder an hundred should be gathered by the Table of Multiplication: so the *sides* of the

the *greater squares* are to be sought out by *Art*. First, the *squares* whose *sides* are simple numbers, are here set downe as you see.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *The Roots.* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| *The Squares.* | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 |

*The knowledge of a square is by finding out his side expressed by a whole number.*

Although the finding out of the *side* of a *square*, be applyed to each number giuen, as to a *square*, yet *square numbers* onely haue a *side* to be expressed by a certaine number of vnites, or by rationall numbers, the other are to be expressed but onely in power. The *sides* are commonly called *Roots by a metaphoricall phrase.*

*The root or side of a square is to be found by the Theorem following.*

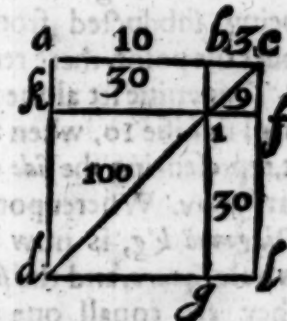
1 If the odde degrees of a *square number* being marked from the right toward the left hand with points, you subduct from the number giuen, the particular *square* of the last *period*, setting the *side* thereof alone by it selfe.

2 Then going on, if you diuide the remainder (if there bee any) with the figure going before it, by the double of the *side* set alone by it selfe.

3 And multiply the *quotient* found out (being placed by the *side*, which was first set alone by it selfe, and also before the doubled number

on the right hand) by both the numbers (namely by the double number, & the Figure ſet by it ſelfe) being counted as one *diuiſor*, ſubducting the products from the giuen number, and then renue this laſt worke of diuiſion ſo many times as there are pricks remaining, the *ſide* of the *ſquare* ſhall be found out.

*This artificiall deuice is taken out of the* 4 *P.* 2 *of* Euclide. *Where by demonſtration it is proued, that if a right line bee cut into two* ſegments, *howſoeuer, the* ſquare *of the whole line is equall to the* ſquares *of the* ſegments, *and to the two* right angled figures *made of the* ſegments *as in the figure annexed, the two* diagonals *k g, & b f, are the* ſquares *of the* ſegments *a b*, and *b c*. *Alſo the* complements *b k, and f g, are the* right angled figures *made by multiplying the line a b*, by *b c*.




To extract the ſquare root.

The ſelfe-ſame parts are to be found in any *ſquare number*. As for *example*, let the *number* be 169, whoſe *ſide* is 13. This *ſide* being diuided into two pieces, 10 and 3, multiplying each piece by it ſelfe once, namely, 10 by 10, and 3 by 3, then multiply one by another, as 10 by 3, and 3 by 10, ſo ſhall you haue foure *plaine numbers*, whereof 2 are *ſquare*, as here you ſee. There-

The firſt example.

Therefore as the *square* 169 is made by adding together of these foure *plaine numbers*, so by subducting them seuerally it is resolued.

| | | |
|---|---|---|
| | 10 | 3 |
| | 10 | 3 |
| | 100 | |
| | 30 | |
| | 30 | |
| | 9 | |
| | 169 | |

First, therefore I marke each odde place with points, because the *particular squares* are to bee found in the odde places. Then for so much as the vnitie standing vnder the first point next the left hand, and representing the last *period*, is both a *square* and the *side* of a *square*: that *figure* therefore being set alone in the *quotient*, and being subducted from the vnitie standing ouer the point, there remaineth nothing.

This vnitie set alone by it self in the *quotient*, shall signifie 10, when another *figure* is set by it, representing the *side* of some other particular *square*. Whereupon I say, that the greater *Diagonall* $kg$, is now subducted from the whole *square*, and the *side* of it $ki$, or $ab$, (for they are equall one to another) and also the *side* of one of the *complements* is found out.

*This is the first step to this resolution.*

Moreouer, I double the *figure* found out, because being doubled, it is the side of both the *complements* taken iointly together, namely, $ki$, and $gi$. Then setting 2 the doubled number vnder

vnder 6, I diuide 6 (which in this place is as much as 60, and repreſenteth both the *complements*) by 2, the *quotient* is 3, repreſenting the other *ſide* remaining of the *complement*, namely *if*, or *b e*, which number I ſet in the *quotient*, and count it for the *ſegment remaining* of the right line giuen. Wherefore becauſe this number 3 is the ſide of the remaining *Diagonall*, that is to ſay, of the leſſer *ſquare b f*: therefore being ſet by the *diuiſor* on the right hand, and multiplyed by it ſelfe, and alſo by the *diuiſor*, it bringeth forth three *plaine numbers*, namly, the *ſquare b f*, and the two *complements a i*, and *il*. which being ſubducted from the numbers ſtanding ouer them, there remaineth nothing.

The example is thus.

| | | | |
|---|---|---|---|
| 1 6 9 ( 1 3 | *Which his all one, as if you had put down the numbers found out in this manner* | 1 6 9 | |
| 2 2 3 | | 1 0 0 | *The greater diagonal.* |
| 3 | | 6 0 | *The comple: two-fold* |
| 6 9 | | 9 | *The leſſer diagonall.* |
| | | 1 6 9 | |

*The ſubtily of this inuention is illuſtrated by many examples.* The ſecõd example.

Let the *ſquare* giuen be 1764. This number being marked with two points, telleth vs, that the *ſide* thereof is to be written with two Figures.

First

First therefore beginning at the point on the left hand, I seeke the side of the last period, namely 17. But for so much as it is no *square* number, I take 4 the *side* of the next lesser square, which I set alone by it selfe in the *quotient*, and then multiply it by it selfe, the *product* is 16, which being subducted from 17, there resteth 1. Moreouer I double the *side* found out, the product is 8, I place this doubled number vnder 6, and by it I diuide 16 standing aboue it, the *quotient* is 2, which must be set by 4. This *quotient* 2 must bee set before the *diuisor* 8 on the right hand vnder the point, and then must it be multipled both by it selfe, and into 8, the *product* is 164. which being subducted from the figures standing ouer them, there remaineth nothing: whereby I gather that the number giuen is a iust *square*.

The example standeth thus.

| | |
|---|---|
| x | |
| x 7 6 4 | ( 42 |
| 1 6 8 2 | |
| 2 | |
| 1 6 4 | |
| 1 7 6 4 | *The Collection.* |

*The same manner of working is to bee followed in greater square numbers giuen, sauing that the former part of the worke is to bee vsed*

*vſed but once, but the latter part is to be followed ſo many times as there are points remaining, excepting the laſt.*

As in 54756. I ſay, that the *ſide* of the *ſquare* next vnto 5 is 2: therefore 2 being ſet in the *quotient*, and multiplied by it ſelfe, make 4, and taken from 5 the remainder is 1. Moreouer I double the *quotient*, the product is 4, which I ſet vnder the next *Figure* toward the right hand, and thereby diuide 14, the *quotient* is 3, which 3 being ſet both in the *quotient*, and alſo before the *diuiſor* toward the right hand, I multiply both the numbers by it, the product is 129: this being ſubducted from 147 ſtanding aboue it, the remainder is 18. But becauſe there is yet one point remaining, with which *I* haue not medled; I therefore againe double all the whole *quotient*, for in this caſe I muſt take 23 for the ſide of one former *ſquare*, & generally in great numbers, when I light vpon more particular *ſquares* then two, I muſt eſteem them but as two, and take the *ſides* which are firſt found out, but as the *ſides* of one onely *ſquare*. Therefore twice 23 is 46: by this *I* diuide 185, the number to be ſet in the *quotient* is 4, which number alſo muſt be ſet before the *diuiſor* on the right hand: then muſt 464 be multiplied by 4: the *product* is 1856, this *product* being ſubtracted from the numbers ſtanding ouer it, there remaineth nothing. The example ſtandeth thus. The third example. Note.

x x 8
5 4 7 5 6 ( 2 3 4
4 4 3 6 4
1 2 9

4
1 8 3 6
5 4 7 5 6 *The Collection.*

*See also the example following.*

1 0 9 4 2 8 6 4 ( 3 3 0 8.

Therefore out of this inuention is this *consectarie.*

4 Example of a surd number.

*The number whose side cannot be expressed by whole numbers, is not a square number:*

Such are all *prime numbers*, and (the *squares* themselues excepted) all other *compound numbers*. For if in them you desire to finde out the *square side*, you shall labour in vaine, because they are not *squares*, for to the whole numbers arising in the *quotient* there will be some *fraction* adioined, whereby it commeth to passe, that the number of the *side* is not to bee expressed by a true number, and it is commonly called a *surd number*.

Notwithstanding if you adioyne to the *side* found out, the number remaining, taking his *denomination* from the double of the *side augmented*

mented by an vnitie, you ſhall finde the next *ſide* that may be like to the *ſide of a ſquare*.

As if from 40 you take the neareſt *ſquare*, to wit, 36, the remainer is 4. Here therefore the *ſide* ſought for of the *ſquare*, exceedeth not the *ſide* found out by an vnity, but either by one, or more parts of ſome whole number: wherefore I double 6, the *ſide* found out, and adde an vnity to it being doubled, the totall is 13, this number I ſet vnder 4 the remainer, and ſay that the *ſide* of 40 demanded as neare as may be, is $6\frac{4}{13}$: the *Denominator* of the *Fraction* being added to the greateſt *ſquare* in the number giuen, namely, vnto 36, maketh the next greateſt *ſquare* aboue it, namely, 49, whoſe *ſide* is 7. But this *ſurd ſide*, to wit $6\frac{4}{13}$, multiplyed by it ſelfe, maketh $39\frac{133}{169}$, which are not iuſt equall to 40, the giuen number.

Iudge the like concerning the reſt which are not *ſquares*.

*Thus much concerning plaine figurate numbers, but eſpecially ſuch as are ſquare numbers.*

## Concerning ſolid figurate Numbers.

*A Solid figurate Number is made of two multiplications by three numbers, or ſides, multiplyed together, admitting length, breadth, and thickneſſe.*

Therefore euery *number* made by the

A solid figurate number.

mutuall multiplication of three numbers, may be called a *solid*, becauſe it bringeth forth *a right angled Parallelipipedon*, diſpoſed according to his vnites in *length*, *breadth*, and *thickneſſe*, the *ſides* whereof are the three multiplying *numbers*. As the *number* 30 made by the mutuall multiplication of 2, 3, and 5, is called an *inequilater ſolid number*, and the *ſides* thereof are 2, 3, and 5, becauſe the vnities thereof diſpoſed by a certaine diſtance one from another, in *length*, *breadth*, and *depth*: as the *ſides* do expreſſe, do bring forth in reſemblance an *inequilater Parallelipipedon*, for that the *numbers* or *ſides* are inequall.

By like reaſon 216 made by multiplication of 6 by 6, and the product thereof by 6, is called an *Equilater ſolid*, for the *ſides* thereof 6 6 and 6 are equall.

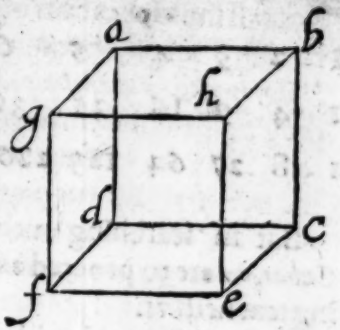
An Equilater Solid or Cube.

*An Equilater, is a number made by three equall ſides, or by any number multiplied by it ſelfe, and that product againe by the foreſaid number. And it is called an Equilater and Equiangled Parallelipipedon or Cube, and is commonly repreſented by vs thus C.*

*A Cube in Geometry is* a right angled *Parallelipipedon*, hauing ſix equall *ſurfaces*, and 8

*ſolid*

*ſolid angles*, & 12 *ſides*, as this figure *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, whoſe *ſide* is *a b*, or *a d*, alſo *b c*, or *c d*, either *c e*, or *e f*, likewiſe *c h*, or *h g*, alſo *g f*, or *d f*, or *d a*, and *g a*.




*The number whereof the Cube is produced by multiplication in it ſelfe twice, is called the ſide or roote of the Cube, which being found out in whole numbers, the Cube is knowne.* The ſide or roote of a Cube.

## Concerning the extraction of the *Cubicke roote.*

THerefore euery *Cube* in numbers hath ſuch a *ſide* as may be expreſſed in whole numbers, but in magnitudes it is not alwayes ſo, as indeed in *magnitudes* there are many things not to be expreſſed in *whole number*. Now for as much as the *ſide* of any *Cube* vnder 1000, is a ſimple figure, it is neceſſarie, before we vndertake to finde out the *ſide* of any great number, to know what *Cube* is made of each *ſimple figure*, and what is the *ſide* of any *Cube* leſſer then 1000, as I haue here ſet them downe.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Roots.* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| *Squares.* | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 |
| *Cubes.* | 1 | 8 | 27 | 64 | 125 | 226 | 343 | 512 | 729 |

But in ſearching out the *ſides* of greater *Cubes*, we are to proceed as the *theorem* following teacheth vs.

If you diſtinguiſh with *points* as it were into periods, the giuen *Cube*, beginning at the firſt figure on the right hand, and omitting each two figures continually, and firſt of all ſubduct the *particular Cube*, of the laſt *period* from the giuen number, ſetting the *ſide* thereof in the *quotient*: and then ſet triple of the *quotient* vnder the *figure* next following the former *point* on the right hand, and the *ſquare* of the *quotient* being tripled beneath it one *degree* more toward the left hand: and afterward diuide the number aboue written by the triple of the *ſquare*, ſetting the *quotient* by it ſelfe, and then multiply the *diuiſor* by the *quotient* found out, and the tripled *ſquare* by the *ſquare* of the *quotient*, and the *quotient cubically*, ſubducting the *products* (ſo orderly added together, that each *figure* may anſwer the *numbers* whereof it was multiplied) from the *number* giuen, and renue this laſt manner of diuiſion ſo many times as there are *points* remaining, the *ſide* of the *Cube* ſhall be found out.

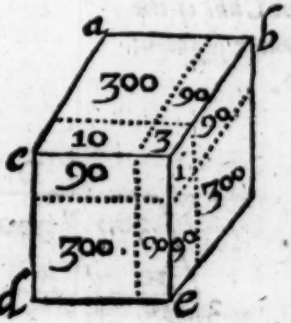
This

This artificiall deuice is drawne out of that *theorem* which *Ramus* made, imitating that of *Euclide* concerning *square numbers* in this manner.

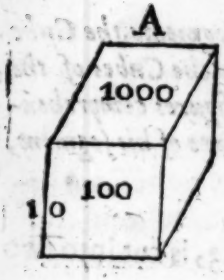
*If a right line be cut into two segments, the Cube of the whole line shall be equall to the Cubes of the segments, and to the two solide figures comprehended three times vnder the square of his segment, and the segment remaining.*

The extraction of the cubicke side or roote.

As the line *c i*, which is 13, is cut into two *segments*, 10 *and* 3 therfore the *Cube* of the whole line, namely 2197, is equall vnto the *Cubes* of the *Segmẽts*, namly vnto 1000, & 27 also to the *two-fold solids* or *Parallelipipedons* thrice taken, whereof three haue like *soliditie*, the *soliditie* of each of the three lesser is 90, being made of the *square of the segment* 3, that is to say of 9, multiplied by the other *segment* 10. These three *Parallelipipedons* iointly taken together, make 270. But of the three greater *Parallelipipedons* each containeth 300, being made of 100, the *square of* the greater *segment* 10, multiplied by the *lesser segment* 3;



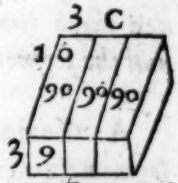
and they beeing taken ioyntly together, make 900.



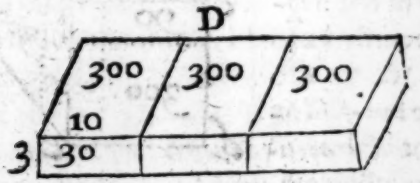

*The Cube of the greater ſegment 10.*

*The Cube of the leſſer ſegment 3.*




*The 3 leſſer Parallelipipedons,*




*The three greater Parallelipipedons.*

The *Cube* therefore hath eight *particular ſolids in number*, which are made of the parts of the number giuen, namely of 10 and 3, in this maner. Firſt let there be foure *plaine numbers* made, each part being multipled by it ſelfe; and one by another,

| | |
|---|---|
| 10 | 3 |
| 10 | 3 |

| |
|---|
| 9 |
| 30 |
| 30 |
| 100 |

If againe I multiply the *Plaines* by the ſame parts, there will ariſe 8 *ſolids*, as you ſee heere.

| | | | |
|---|---|---|---|
| 9 | | 9 | |
| 30 | | 30 | |
| 30 | | 30 | |
| 100 | | 100 | |
| 3 | | 10 | |
| 27 | | 90 | *All theſe being added togeather, are equall to the Cube of the whole, to wit,* |
| 90 | | 300 | |
| 90 | | 300 | |
| 300 | | 1000 | 2197. |

*Therefore the ſame way that is kept in making the* Cube, *is alſo to bee followed in reſoluing the* Cube.

The firſt example to extract the cubick Roote.

As for example, I marke the *Cube* giuen with points in this manner, 2197

Then I ſubduct the particular *Cube* of the number ſet vnder the laſt point: but for ſo much as that number is no *Cube*, I take the neereſt to it, namely, an vnity, which alſo I ſet in the *quotient*. This vnity in the number giuen, is 100, but in the *quotient* it is but 10, the vnite ſubducted from 2, the remainder is 1, which muſt bee written ouer the number giuen

giuen. So that the greater *Cube A*, is to be ſuppoſed to bee ſubducted from the number giuen.

*This is the firſt ſtep of this worke.*

1
2197 (1
A

After I triple the *quotient* found out (that is to ſay, I multiply it by 3) this triple repreſenteth the three *ſides* (ioyntly taken together) of the three leſſer *ſolids* marked with *C*, I place the tripled number vnder 9. Againe, I multiply the *quotient* ſquare wiſe, & triple the *product*, which maketh likewiſe 3. This *product* reſembleth the three *ſquare ſides* (taken ioyntly together) of the three *greater ſolids*, marked with *D*, I place the *product* ona degree lower toward the left hand vnderneath 1. With it I diuide 11, which written aboue it, the *quotient* is 3. This *ſegment* or *quotient* 3, being multiplyed by 3 the *Diuiſor*, maketh 9, which in reſpect of the place wherein it ſtandeth, is 900, & repreſenteth the three greater *ſolids*, marked with *D*, taken ioyntly together. Furthermore the ſame *quotient* being multiplied ſquarewiſe, maketh 9, and multiplyed afterward by the triple *number* ſtanding vnder 9, it maketh 27, which in reſpect of the place wherein it ſtandeth, is 270, & repreſenteth the three *leſſer ſolids* marked with *C*. Laſt of all, the ſame *quotient* multiplie

plied *cubically*, breedeth the *leſſer Cube B*. Theſe three *products* therefore being added together, and the totall ſubducted from the *numbers* ſtanding ouer it, there remaineth nothing, which importeth the giuen number is a *Cube*.

*The example is as you ſee.*

| | | | |
|---|---|---|---|
| 1 | | 2197 | (13 |
| 2 197 | (13 | 1000 | *The greater Cube.* |
| 1 3 | | 3 | |
| 3 | | 3 | |
| 9 | Or thus: | 900 | *The 3 greater Parallelipipedons.* |
| 27 | | 270 | *The leſſer Parallelipipe.* |
| 27 | | 27 | *The leſſer Cube.* |
| 2197 | | 2197 | |

*The matter may be explained by many examples.*

Let the ſide of the giuen *Cube* 16387064. be ſought out, contriue it therefore (as it were) into certaine periods with points. Then firſt of all, ſearch out the *ſide* of the *Cube* next to the left hand: But for as much as 16 is no *Cube*, take 2 the *ſide* of the next *Cube* vnder it, that is to ſay, of 8, and ſet it in the *quotient*, and ſubduct 8 the *Cube* thereof from 16, there remaineth 8. This firſt worke is not to bee renued throughout the whole *number*, but the *rules* following muſt bee repeated as often as there are *points* remaining. The ſecond example of the Cubick root.

The

*The first step to finde out the root, is in this manner.*

8
1 6 3 8 7 0 6 4 (2
8

Moreouer, triple the *quotient* now found out, and the *product* is 6, which is to be placed vnder 8, namely, vnder the *figure* following the next *pricke* toward the right hand. Then multiply the *quotient* by this tripled *number* (or which is all to one purpose, square the *quotient* and then triple the *product*) it maketh 12, set that number in a lower place one degree nearer the left hand, and make it the *diuisor*: diuide 83 by 12, obseruing this *rule* in chooſing your *quotient*, that it be no greater, then that the *numbers* afterward produced by multiplication may not exceed the *numbers* ſtanding ouer it. So that here you ſhall take 1 in 8, but 5 times. Afterward by this number 5, multiply the *diuiſor* 12, and by the *ſquare* of 5, multiply the tripled *number* 6, and laſt of all multiply 5 *cubically*: ſo ſhall you produce three *numbers*, namely, 60, 150, 025, to bee deſcribed in ſuch ſort as you ſee. Theſe *numbers* added together, and ſubducted from 8387, the remainer is 762.

*The ſecond ſtep to finde out the root, is in this manner.*

87

```
  8762
 163870̇64̇ (25
-----
    6
  12
-----
  60
 150
   125
-----
 7625
```

*And because there is yet one point remaining, this last manner of Diuision must bee wrought againe.*

First therfore I triple the *quotient*, the *product* is 75. which must be so placed, that the *first figure* thereof, namely 5, may stand vnder 6, the *second* vnder the 0. Againe, multiply the *quotient* by this *tripled number* (or which is all one, *square the quotient*, and triple the *product*) it maketh 1875, which must bee the *Diuisor*, whose first *figure* namely 5, must be placed vnder 7, the *last figure* of the *tripled number*. Then see that 1 may be contained in 7, many times, but I can take it but 4 times, I set 4 in the *quotient* and multiply the *Diuisor*, by 4, the *product* is 7500, afterward *I square* 4, it maketh 16 which I multiply by the *tripled number* 75, the *product* is 1200. Last of all I multiply 4 *cubically*, it maketh 64, these *products* added all together,

ther, make 762064, which *number* being ſubducted from the *Cube* giuen, there remaineth nothing, whereby I gather that the number giuen is exactly *cubicall.*

*The third ſtep to finde out the ſide is in this manner.*

```
      7 6 2
  . .   .   .
1 6 3 8 7 0 6 4 (2 5 4
-----------------
        7 5
    1 8 7 5
  -----------
      7 5 0 0
        1 2 0 0
            6 4
  -------------
      7 6 2 0 6 4
```

*Behold alſo the example following.*

The third example of the cubick root.

```
  .   .   .   .
6 1 4 1 2 5 0 0 0 (8 5 0
```

¶ Another manner of working.

*HItherto the Princely high-way to find out the ſide of the* Cube *hath been declared.*

But there are moreouer certaine other waies alſo bending thereto, and leaning to the ſame principles, whereof this is one.

The ſecond forme.

Hauing found out in the Table of ſimple *Cubes*, the firſt figure repreſenting the ſide of the *Cube* contained, in the number ſtanding vnder the firſt *point* on the left hand, ſet it in the

I

*quotient*

*quotient*, & ſubduct the particular *Cube* of that figure as you did before: then *ſquare* that *figure*, and triple that *ſquare* the *product* ſhall be the *Diuiſor*, the firſt *figure* whereof ſhall bee ſet vnder that *figure* which is on the right hād next of all to the *point* (now examined) before going.

See how many times the *Diuiſor* is contained in the number written ouer it, and multiply the *Diuiſor* in the *quotient*, and ſubduct the *product* from the *dividend*: yet heere you muſt take heed, that you take not a greater *quotient*, then that the *products* made afterward therby may be ſubducted from the *number* giuen. 2 3

The ſubduction being done, triple the firſt *figure* which was ſet in the *quotient*, and adde to the triple the laſt *number* which was ſet in the *quotient* on the right hand of the *product*.

This totall multiplied by the *ſquare* of the *figure* laſt found out, and ſet downe the *product* ſo, that the firſt *figure* thereof toward the right hand may ſtand vnder the *point* next before going on the ſame hand, and finally ſubduct the ſame from the *number* giuen. 4

As in 804357. The particular *Cube*, namely, 729 being taken from the *number* ſtanding vnder the laſt *period* vpon the left hand, there remaineth 75357, the ſide of that particular *Cube* being 9, I ſet in the *quotient*. Then I *ſquare* that *ſide*, it maketh 81, & triple the *ſquare*, the *product* 243 is my *diuiſor*, which I ſet vnder the giuen *number*, ſo that 3 may ſtand vnder 3 with

The fourth example of the cubick roote.

with this *diuiſor*; diuide the *number* ſtanding ouer it, you ſhall finde 2 to be conteined in 7 three times. Therefore I ſet 3 in the *quotient*, & multiply the *diuiſor* by it, the *product* is 729, which being ſubducted from 753, the remainder 24.

*The induction is thus:*

2
7 5 4
8 0 4 3 5 7 (93
2 4 3
7 2 9

Moreouer I triple 9, the *product* is 27, by which on the right hand I ſet 3, the *quotient* laſt found out, the totall is 273.

This *number* I multiply by 9 the *ſquare* of the *quotient* laſt found out, the *product* ſhall bee 2457, which being ſubducted from the ſuperiour *number*, there remaineth nothing.

*The induction is thus:*

2 4
8 0 4 3 5 7 (93
2 7 3
9
2 4 5 7

Another

*Another manner.*

*THe selfe-same worke may be dispatched another way a little differing from the former in this manner.*

The *figure* in the *quotient* being found out by subducting the particular *Cube*, and also the second *figure* in the quotient being found by diuision, let the totall *quotient* be tripled, & let the tripled *number* bee multiplied by the former *figure* in the *quotient*. Then let the *product* be multiplied againe, be the latter *figure* found out, and let a *cypher* be set on the right hand of that *product*. Last of all, let the *Cube* of the latter *figure* found out, bee adde to this *product*, and let the totall *summe* be subducted from the number giuen. As in 373248.

The third forme.

*The first induction is in this manner,*

39.

373 248 (7

343

Moreouer I *square* the *side* found out, it maketh 49, and triple the *square*, the *product* is 147, which shall be the *diuisor*, by this I diuide 302, the number written ouer it, the *quotient* is 2. Now I triple the totall *quotient* 72, it maketh 216, and multiply this triple by 7, the former *figure* in the *quotient*, the *product* is 1512. I multiply this *product* by 2, the latter *figure* of the *quotient*, and set a *cypher* on the right hand of it, so it maketh 30240, vnto this number last of all I adde 8, the *Cube*

The fift example.

of the latter *figure* found out, the total is 30248 which being ſubducted from the *figure* aboue it, there remaineth nothing.

*The ſecond induction is thus.*

30
8 7 8 2 4 8 (72
147
30248

¶ All the *points* of the *number* giuen being examined, if any thing remaine, it ſignifieth the *number* giuen is no *Cube*: wherefore the true *ſide* of it cannot be exactly giuen in *numbers*. Yet if it pleaſe you to ſiſe out the neereſt *ſide* that may be, by the firſt kinde of reduction of *mixt numbers*, you ſhall reduce the *number* giuen vnto a *cubicall* fraction of a greater *denomination*, and afterward ſeeke out the *cubicall ſide* of that *fraction*.

To finde the neereſt Cubicke roote in a ſurd number.

For example ſake, becauſe 120 is no *Cube*, therefore let it be reduced into ſixty *cubicall* parts, after this manner. Multiply 60 *cubically* in it ſelfe, it maketh 216000, by this being taken for the *denominator* of the *fraction*, multiply 120 the *number* giuen, the *product* is 2592000 whoſe *cubicall ſide* is $\frac{136}{60}$ that is $4\frac{11}{15}$ the neereſt to the true *ſide* that can be.

*For the extraction of all ſorts of roots, the table of Logarithmes ſet forth by* Mr. *Briggs are moſt excellent, and ready.*

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how much in *length* of any *breadth* of *board* must be in one *foote*.

By the like meanes ſuppoſe *for example* that a *board*, appointed to be meaſured, is 15 *inches* ¾ *broad*, if I deſire to know how much in *length* thereof will make a *foote*, I ſeeke in the *columnes* that ſtand vnder *vnites and quarters*, for 15 ¾, and alſo againſt the ſame in the *columne* vnder the title of *board meaſure*, where I finde 9 *inches* 1 *prime or tenth* of an *inch*, and 4 *ſeconds* or *hundreths* of an *inch* will make a *foote* at that *breadth*: the like may be practiſed for any other *breadth of board* whatſoeuer.

# Certaine Tables shewing the interest of any *sum of mony* whatsoeuer vnto 40 yeers; How much *Annuities* respited or forborne commeth vnto. And for *buying or selling* of *Annuities* for the said time; and also the same in *reuersion* after any *number* of *yeres* vnto 30. what they may be worth in present ready money, by I. C. and now diligently corrected and amended by *Robert Hartwell.*

## Definition of Interest.

PRincipall, *is the summe from which the* Interest *is reckoned.*

2 Interest *is the summe reckoned for the lending or forbearance of the* Principal *for any terme or time.*

3 Interest simple *is that which is counted from the* Principall *onely.*

4 Interest compound, *is that which is counted for the* Principall, *together with the* Arerage.

5 Interest profitable, *is that which is added to the* Principall.

6 Interest damagable, *is that which is to bee subtracted from the* Principall.

| | | | |
|---|---|---|---|
| The vse per annum of | 1 li. | is | 2 s. |
| | 10 s. | | 12 d. |
| | 5 s. | | 6 d. |
| | 2 s. 6 d. | | 3 d. |
| | 12 d. | | 1 d. $\frac{1}{5}$ of a penny. |

A

*A Table shewing what* 1 l. *with interest, and interest upon interest after* 10 *in the* 100. *comes to every yeere under* 41 *yeeres. As followeth.*

| yeeres. | l | s | d | l | s | d | yeeres. |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 0 | 7 | 8 | 0 | 21 |
| 2 | 1 | 4 | 2 | 8 | 2 | 9 | 22 |
| 3 | 1 | 6 | 7 | 8 | 19 | 1 | 23 |
| 4 | 1 | 9 | 3 | 9 | 16 | 11 | 24 |
| 5 | 1 | 12 | 2 | 10 | 16 | 8 | 25 |
| 6 | 1 | 15 | 5 | 11 | 18 | 4 | 26 |
| 7 | 1 | 18 | 11 | 13 | 2 | 2 | 27 |
| 8 | 2 | 2 | 10 | 14 | 8 | 5 | 28 |
| 9 | 2 | 7 | 1 | 15 | 17 | 3 | 29 |
| 10 | 2 | 11 | 10 | 17 | 8 | 11 | 30 |
| 11 | 2 | 17 | 1 | 19 | 3 | 10 | 31 |
| 12 | 3 | 2 | 9 | 21 | 2 | 3 | 32 |
| 13 | 3 | 9 | 0 | 23 | 4 | 6 | 33 |
| 14 | 3 | 15 | 11 | 25 | 10 | 11 | 34 |
| 15 | 4 | 3 | 6 | 28 | 2 | 0 | 35 |
| 16 | 4 | 11 | 10 | 30 | 18 | 3 | 36 |
| 17 | 5 | 1 | 1 | 34 | 0 | 0 | 37 |
| 18 | 5 | 11 | 2 | 37 | 8 | 1 | 38 |
| 19 | 6 | 2 | 3 | 41 | 2 | 10 | 39 |
| 20 | 6 | 14 | 6 | 45 | 5 | 2 | 40 |

By the former Table, if you deſire to know what 1 li. commeth to with *intereſt*, and *intereſt* vpon *intereſt* after 10 in the 100. for any *number* of yeares vnto 40. Looke in the *rowe or margent* (ouer which is written *yeeres*) and againſt it on the right hand cloſe vnto it in the the *rowe or Margent of pounds, ſhillings, and pence*, (which is titled thus, li. ſ. d. you ſhall find your deſire.

*Example.*

*I would know what* 1 li. *with intereſt, and intereſt vpon intereſt commeth to in* 7 *yeares?*

I looke in the rowe of *yeeres* for the *number* 7. And againſt it on the right hand I finde 1. li. 18. ſ. 11. d. Alſo what it commeth vnto in 13. yeares. I ſeeke among the yeares for 13. and againſt it I finde 3. li. — 9. ſ. Againe for 21. yeares, I looke for 21. among the yeares and I finde 7 li. 8. ſ. 0. d. But if you would know for a greater ſumme then 1. li. Then multiply your ſumme by that ſumme of 1. li. in the Table for any of thoſe yeeres, and you ſhall eaſily finde it. As thus, I would know what 10. li. commeth to for 7 yeares with intereſt, &c. I ſee that 1. li. commeth to 1. l. 18. ſ 11. d. in that time. Then ſay I that 10. li. muſt be 10. times as much in that ſpace, which is 19 li. 9 ſ. 2. d. Alſo of 10. li. in 13. yeeres. I ſee that 1. li. in that time commeth vnto 3. li. 9. ſ. Then muſt 10. li. bee 10. times as muſt in that ſpace, which is 34. li. 10. ſ. Alſo what 10. li. commeth

commeth to in 21 yeares. I finde firſt that 1 li. in that ſpace commeth to in 7 li. 8 ſ. Then I ſay 10 muſt be 10 times as much, which is 74 li. Laſtly, I would know what 100 li. commeth to in 7 yeares, I ſee it muſt bee 100 times as much as 1 li. commeth to in that ſpace, which is 194 li. 11 ſ. 8 d. Hereby you ſee the common ſaying is not true, that 100 li. doth double it ſelfe in 7 yeares, for it wants thereof 5 li. 8 ſ. 4 d. But in 8 yeares 100 li. commeth to 210 li. 8 ſ. 4. d. Which you ſee is more then double it ſelf by 10 li. 8 ſ. 4 d. And in this ſort may any that can but caſt with Counters, or indeed by memory finde the encreaſe of any ſumme whatſoeuer for any of the number of yeares in the foreſaid Table, after they haue found what 1 li. commeth vnto for that time, as before is ſpecified.

*A Table ſhewing if* 1 l. *Annuity to endure for any number of yeares, vnder* 41. *be all reſpited or forborne, vntill the laſt payment grow due, and then all be receiued together: with intereſt, and intereſt vpon intereſt after* 10 *in the* 100 per annum, *what they will amount vnto by any of the ſaid number of yeares. As followeth.* Viz.

| yeares. | l | s | d | l | s | d | yeeres. |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 64 | 0 | 0 | 21 |
| 2 | 2 | 2 | 0 | 71 | 8 | 0 | 22 |
| 3 | 3 | 6 | 2 | 79 | 10 | 10 | 23 |
| 4 | 4 | 12 | 10 | 88 | 9 | 11 | 24 |
| 5 | 6 | 2 | 1 | 98 | 6 | 11 | 25 |
| 6 | 7 | 14 | 3 | 109 | 3 | 7 | 26 |
| 7 | 9 | 9 | 8 | 121 | 1 | 11 | 27 |
| 8 | 11 | 8 | 8 | 134 | 4 | 2 | 28 |
| 9 | 13 | 11 | 7 | 148 | 12 | 7 | 29 |
| 10 | 15 | 18 | 8 | 164 | 9 | 10 | 30 |
| 11 | 18 | 10 | 7 | 181 | 18 | 10 | 31 |
| 12 | 21 | 7 | 8 | 201 | 2 | 9 | 32 |
| 13 | 24 | 10 | 5 | 222 | 5 | 0 | 33 |
| 14 | 27 | 19 | 5 | 245 | 9 | 6 | 34 |
| 15 | 31 | 15 | 9 | 271 | 0 | 5 | 35 |
| 16 | 35 | 18 | 11 | 299 | 2 | 6 | 36 |
| 17 | 40 | 10 | 10 | 330 | 0 | 9 | 37 |
| 18 | 45 | 11 | 11 | 364 | 0 | 10 | 38 |
| 19 | 51 | 3 | 2 | 401 | 8 | 11 | 39 |
| 20 | 57 | 0 | 6 | 442 | 11 | 10 | 40 |

By this Table you may know what any Annuitie being reſpited or forborne for any number of yeares vnto 41. with intereſt vpon int. after 10 in the 100 will come vnto: firſt ſeeking in the Table what 1 li. will come vnto in that time, and that being found to multiply it by the ſumme you deſire to know.

*Example.*

*Firſt, I would know what* 1 li. *Annuity, being forborne or reſpited for* 14 *yeares commeth vnto.*

I looke in this laſt Table (which is for purpoſe) and I finde 27 li. 19 ſ. 5 d.

Againe, what 1 li. *Annuity* reſpited for 21 *yeares* commeth to, I looke in the ſaid Table for 21 *yeares*, and I finde 64 li. Alſo the like for 1 li. for 30 *yeares* reſpited. I looke, and I finde it to be 164 li. 9 ſ. 10 d. as by the ſaid Table may appeare. Now for greater *Annuities*, as 30 li. *per annum*, reſpited or forborne, what it amounteth to in 16 *yeares*. I ſeeke firſt for 1 li. in this laſt *Table* before for 16 *yeares*, and againſt it I finde 35 li. 18 ſ. 11 d. Then ſay I, that 30 li. *per annum* being reſpited for that time, will come to 30 times as much, which is 1078 li. 7 ſ. 6 d. Alſo if there be an *Annuitie* of 45 li. due and vnpayed for 12 *yeares*. I looke in the ſaid Table what 1 li. commeth to, 12 yeares being reſpited, and I finde it it is 21 li. 7 ſ. 8 d. Then I conclude that

5 li.

5 li. muſt bee 45 times as much, which is 962 li. 5 ſ.

*Laſtly, I haue an Annuitie of* 50 li. *per annum, which hath beene behinde for* 16 *yeares, and muſt be anſwered vnto me with intereſt, and intereſt vpon intereſt, all at one payment, what ſhall or ought I to receiue in all at the* 16 *yeares end?*

I ſeeke what 1 li. comes vnto in that time (as before taught) and I finde 35 li. 18 ſ. 11 d. Then muſt my 50 li. *per annum* forborne for that time, come to 50 times as much, which is 1797 li. 6 ſ. 10 d. And thus may you finde any other *ſumme* great or ſmall, for any *number* of *yeares* contained in the foreſaid *Table*, without the helpe of *Aritbmeticke*, if you can but vſe your *Counters*, or by memory count well.

*A Table shewing if* 1 l. *Annuity (to endure for any number of yeeres vnto* 41 *) bee to bee sold for present ready money, how much ought that ready money to bee, reckoning* 10. per 100. per annum *abating interest, and interest vpon interest, As followeth.*

| yeeres. | l | s | d | l | s | d | yeeres. |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 18 | 2 | 8 | 12 | 11 | 21 |
| 2 | 1 | 14 | 8 | 8 | 15 | 5 | 22 |
| 3 | 2 | 9 | 8 | 8 | 17 | 7 | 23 |
| 4 | 3 | 3 | 4 | 8 | 19 | 8 | 24 |
| 5 | 3 | 15 | 9 | 9 | 1 | 6 | 25 |
| 6 | 4 | 7 | 1 | 9 | 3 | 2 | 26 |
| 7 | 4 | 18 | 4 | 9 | 4 | 8 | 27 |
| 8 | 5 | 6 | 8 | 9 | 6 | 1 | 28 |
| 9 | 5 | 15 | 2 | 9 | 7 | 4 | 29 |
| 10 | 6 | 2 | 10 | 9 | 8 | 6 | 30 |
| 11 | 6 | 9 | 9 | 9 | 9 | 7 | 31 |
| 12 | 6 | 16 | 3 | 9 | 10 | 6 | 32 |
| 13 | 7 | 2 | 0 | 9 | 11 | 4 | 33 |
| 14 | 7 | 7 | 4 | 9 | 12 | 2 | 34 |
| 15 | 7 | 12 | 1 | 9 | 12 | 10 | 35 |
| 16 | 7 | 16 | 5 | 9 | 13 | 6 | 36 |
| 17 | 8 | 0 | 5 | 9 | 14 | 1 | 37 |
| 18 | 8 | 4 | 0 | 9 | 14 | 7 | 38 |
| 19 | 8 | 7 | 3 | 9 | 15 | 1 | 39 |
| 20 | 8 | 10 | 3 | 9 | 15 | 6 | 40 |

This Table before last specified is very necessary and commodious for all *Gentlemen* or others, that shall haue cause to buy or sell *Annuities* or such like, for by this they shall know what they doe, whether they demaund, or take too litle or too much, after the rate of 10. in the 100 by which proportion all these *Tables* are ruled.

*As for example, I am to buy an Annuity of* 16. li. per annum *for* 12 *yeeres, and am demanded for it in ready mony* 120. li. *I would know, if I giue this rate, whether I giue too much or too little, according to the proportion of* 10 *in the* 100 *per annum, &c.*

I looke in the *Table* last before what 1 li. is worth for 12. *yeeres*, and I find against 12 this *summe* 6 li. 16. s. 3. d. Now I say that 16. l. *Annuity* for that time, and after that proportion commeth to 16 times as much, which is 100. li. So that I see the party demaunded of mee 11. li. too much after the rate of 10. in the 100 *per annum*, and therefore I must draw him to a lower price, or leaue it.

*Againe, I am offered an Annuity of* 20. li. *per annum of* 14. *yeeres for* 130. li. *I would know if I giue it, whether I giue too much or too little, according to the proportion aforesaid.*

I seeke first what 1. li. *Annuitie* is worth for 14 *yeeres*, and I finde in the said last *Table* 7. l. 7. s. 4. d. Then say that the *Annuity* of 20. li. *per annum*, will come to 20. times as much, & will be worth 147. li. 6. s. 8d. according to

the

the proportion before mentioned, and is more then his demand by 17 li. 6 ſ. 8 d. So that I ſee, if I accept of it, I ſhall haue a good *bargaine*. And thus may you know readily by looking in your *Table*, and finding what 1 li. is worth for any time therein contained, how much any greater *ſumme* will come vnto, if you multiply it by that *ſumme* of 1 li. as before is ſufficiently ſhewed.

*But ſuppoſe this: I haue* 300 li. *ready money & would beſtow the ſame for a valuable Annuity anſwerable thereunto according to the proportion aforeſaid. I would know what Annuity to endure* 21 *yeares this* 300 li *will buy?*

I looke in the former *Table* what 1 li. *Annuitie* will coſt for that time, and I finde 8 li. 12 ſ. 11 d. Then I ſay by the *Rule of Proportion*. If 8 li.-12 ſ-11 d. will buy 1 li. *Annuity* for 21 *yeares*: what *Annuity* ſhall 300 li buy or be worth for that time, I reduced the *ſummes* to the leaſt *denomination* (which is *pence*) and I finde 34 li. 10 ſ. 9 d. And after this manner (by the helpe of this *rule*) may you finde all other ſummes for any time contained in the foreſaid laſt *Table*.

*A Table ſhewing what* 1 *li. in reuerſion for any number of yeares vnder* 31 *is worth in ready money, the buyer ſtaying vntill the thing be fallen in hand.*

| yeares. | li. | ſ | d. | li. | ſ | d. | yeares. |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 18 | 2 | 0 | 4 | 4 | 16 |
| 2 | 0 | 16 | 6 | 0 | 3 | 11 | 17 |
| 3 | 0 | 15 | 0 | 0 | 3 | 7 | 18 |
| 4 | 0 | 13 | 7 | 0 | 3 | 3 | 19 |
| 5 | 0 | 12 | 5 | 0 | 2 | 11 | 20 |
| 6 | 0 | 11 | 3 | 0 | 2 | 8 | 21 |
| 7 | 0 | 10 | 3 | 0 | 2 | 5 | 22 |
| 8 | 0 | 9 | 3 | 0 | 2 | 2 | 23 |
| 9 | 0 | 8 | 5 | 0 | 2 | 0 | 24 |
| 10 | 0 | 7 | 8 | 0 | 1 | 10 | 25 |
| 11 | 0 | 7 | 0 | 0 | 1 | 8 | 26 |
| 12 | 0 | 6 | 4 | 0 | 1 | 6 | 27 |
| 13 | 0 | 5 | 9 | 0 | 1 | 4 | 28 |
| 14 | 0 | 5 | 3 | 0 | 1 | 3 | 29 |
| 15 | 0 | 4 | 9 | 0 | 1 | 1 | 30 |

This laſt *Table* differeth, and is contrary to the other three before mentioned: For whereas the others increaſed more and more according to the *number of yeares* ſpecified. This doth grow and diminiſh leſſe and leſſe, as the *number of yeares* increaſeth. As for *example.*

*There is a Tenement, the fee ſimple whereof after 7 yeares will bee worth* 40 li. *what am I to giue for it in ready money, now ſtaying vntill it fall in hand.*

To know this, I looke in this laſt *Table* for 7 *yeares*, and againſt it I finde 10 ſ. 3 d. So that a thing that after 7 *yeares* will be worth 1 li. is worth now in ready *money* but 10 ſ 3 d. Then ſay I that the foreſaid Tenement (which after 7 *yeares* will be worth 40 li.) is now worth 40 times 10 ſ. 3 d. which is 20 li. 10 ſ.

*Againe, there is a Farme which after 9 yeares will be worth the fee-ſimple* 420 li. *what is it now worth in ready money ſtaying vntill it fall in hand.*

I looke in the ſaid *Table* what 1 li. is worth in reuerſion after 9 *yeares*, and I find 8 ſ 5 d. Then ſay I, that the *Farme* of 420 li. ſo long in reuerſion, will bee now worth in readie money, 420 times as much, which is 176 li. 5 ſ.

*Laſtly, there is a Lordſhip to be ſold, the Fee-ſimple whereof after* 14. *yeares will bee worth* 500 li. *I would know what the ſame is now worth in ready money for the Reuerſion.*

I looke in this laſt *Table* for 14 yeares, and againſt it I finde 5 ſ. 3 d. ſo much 1 li. is worth

in reuerſion after 14 yeares. Then ſay I, that 7500 li. is worth no more in reuerſion for that time then 7500 times 5 ſ. 3 d. which is 1968 li. 15 ſ. And after this manner may you finde out any other *ſumme* whatſoeuer. And though ſome men of their owne experience can ayme (as they thinke) neare enough the marke to ſerue their owne turnes: yet I dare vndertake they ſhall neuer ſo exactly doe it nor iuſtifie what they do, as if they did it by Art.

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# New *Tables* of *Interest* at 8 *per centum*, *per annum*, exactly calculated for 30 *yeares* by *Robert Hartwell*, with neceſſarie *queſtions* for the vſe of them.

*The firſt Table expreſſing the increaſe of one pound prinall, put out and forborne for any number of yeares vnder , at* 8 per centum, per annum.

| yeares. | li. | ſ | d | q. |
|---|---|---|---|---|
| 1 | 1 | 1 | 7 | 0 |
| 2 | 1 | 3 | 3 | 3 |
| 3 | 1 | 5 | 2 | 1 |
| 4 | 1 | 7 | 2 | 2 |
| 5 | 1 | 9 | 4 | 2 |
| 6 | 1 | 11 | 8 | 3 |
| 7 | 1 | 14 | 3 | 1 |
| 8 | 1 | 17 | 0 | 0 |
| 9 | 1 | 19 | 11 | 3 |
| 0 | 2 | 3 | 2 | 0 |
| 1 | 2 | 6 | 7 | 2 |
| 2 | 2 | 10 | 4 | 1 |
| 3 | 2 | 14 | 4 | 2 |
| 4 | 2 | 18 | 8 | 3 |
| 5 | 3 | 3 | 5 | 1 |

| li. | ſ | d | q. | yeares. |
|---|---|---|---|---|
| 3 | 8 | 6 | 0 | 16 |
| 3 | 14 | 0 | 0 | 17 |
| 3 | 19 | 11 | 0 | 18 |
| 4 | 6 | 3 | 3 | 19 |
| 4 | 13 | 2 | 2 | 20 |
| 5 | 0 | 8 | 0 | 21 |
| 5 | 8 | 8 | 3 | 22 |
| 5 | 17 | 5 | 0 | 23 |
| 6 | 6 | 9 | 3 | 24 |
| 6 | 16 | 11 | 2 | 25 |
| 7 | 7 | 11 | 0 | 26 |
| 7 | 19 | 9 | 0 | 27 |
| 8 | 12 | 6 | 2 | 28 |
| 9 | 6 | 4 | 0 | 29 |
| 10 | 1 | 3 | 0 | 30 |

at 6 p Cent.

2.54035
2.69277
2.85433
3.02559
3.20713
3.39956
3.60353
3.81975
4.04893
4.29187
4.54938
4.82234
5.11168
5.41838
5.74349

at 6 p Cent

1.1.06
2.1.12360
3.1.19101
4.1.26247
5.1.33822
6.1.41851
7.1.50363
8.1.59384
9.1.68947
10.1.79084
11.1.89829
12.2.01219
13.2.13292
14.2.26090
15.2.39655

# The deſcription and vſe o the *Tables* of *Intereſt* at 8 *per* 100. *per annum*, being *profitable*.

## The firſt of them.

THeſe *Tables* conſiſt of foure *Columnes*, i the *firſt* and *fourth* whereof is written o uer the head *yeares*, and vnder the *firſt* th number of *yeares* deſcending from 1 to 1 likewiſe in the *fourth* the number of *yeare* deſcending from 16 to 30. And againſt eue ry *yeare* in the *ſecond Columne* toward th right hand, the *pounds*, *ſhillings*, *pence* and *far things*, which one *pound*, or 20 *ſhillings* prin cipall will amount vnto, being put forth an forborne for the number of *yeares* ſet again it; (but the *pounds*, *ſhillings*, *pence*, &c. in th third *Columne* belongeth to the *yeares* ſet i the laſt *Columne*.

I Exam

## 1 Example.

*Let it be required what one pound or* 20 *ſhillings, being put forth and forborne for* 12 *yeares ariſeth to at* 8 per 100, per annum, *intereſt vpon intereſt.*

Seeke in the *firſt Columne* vnder the *title of yeares*, for 12 the number of *yeares* propoſed in the queſtion, and right againſt it toward the right hand in the *ſecond Columne*, you ſhall finde 2 li.—10.—4 d—1 q, which is the *principall* and *increaſe* thereof due for the time required.

## 2 Example.

*If* 100 li. *be put forth for* 17 *yeares according to the ſame intereſt. I demand what it will amount to in that time?*

Looke in the *Columne* vnder the *title* of *yeares* for 17, and right againſt it towards the left hand in the *Table* is found 3 l.—14 ſ —0 d—0 q, which is the encreaſe of 1 li.

by which you may thus gather the increaſe of 100 li. or any other *ſumme*; a hundreth times 3 li. is 300 li. then 100 times 14 *ſhillings* is 70 li. both which added together doe make 370 li—0 s—0 d. which is the *increaſe* of 100 li put forth and forborne 17 *yeares* the ſolution to the queſtion.

| li | ſ | d | q |
|---|---|---|---|
| 300 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 |
| 370 | 0 | 0 | 0 |

## 3 Example.

*Suppoſe* 60 li *be put forth for* 19 *yeares according to that rate, what will it increaſe to in that time?*

Seeke 19 vnder the *title* of *yeares*, and againſt it toward the left hand is found 4 li—6 s-3 d-3 q now ſay 60 times 4 li is 240. and 60 times 6 *ſhillings* is 360 *ſhillings* or 18 li. and 60 times 3 d is 180 d. or 15 *ſhillings*, and 60 times 3 *farthings* is 3 *ſhillings* 9 d. all which added together make 258 li. 18 ſ. 9 d. the increaſe thereof demanded.

| li | ſ | d | q |
|---|---|---|---|
| 240 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 |
| 0 | 15 | 0 | 0 |
| | 3 | 9 | 0 |
| 258 | 18 | 9 | 0 |

The

*The second Table shewing what one pound Annuity or yearly rent is worth at the end of any number of yeares under 31, being forborne, at 8 per centum, per annum.*

| yeeres. | li | s | d | q |
|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 |
| 2 | 2 | 1 | 7 | 0 |
| 3 | 3 | 4 | 11 | 0 |
| 4 | 4 | 10 | 1 | 1 |
| 5 | 5 | 17 | 3 | 3 |
| 6 | 7 | 6 | 8 | 0 |
| 7 | 8 | 18 | 5 | 1 |
| 8 | 10 | 12 | 8 | 3 |
| 9 | 12 | 9 | 9 | 0 |
| 10 | 14 | 9 | 8 | 3 |
| 11 | 16 | 12 | 10 | 3 |
| 12 | 18 | 19 | 6 | 2 |
| 13 | 21 | 9 | 10 | 3 |
| 14 | 24 | 4 | 3 | 2 |
| 15 | 27 | 3 | 0 | 2 |

| li. | s | d | q | yeeres | at 6 p Cent. |
|---|---|---|---|---|---|
| 30 | 6 | 5 | 3 | 16 | 25.67252 |
| 33 | 15 | 0 | 0 | 17 | 28.21287 |
| 37 | 9 | 0 | 0 | 18 | 30.90565 |
| 41 | 8 | 11 | 0 | 19 | 33.75999 |
| 45 | 15 | 2 | 3 | 20 | 36.78559 |
| 50 | 8 | 5 | 2 | 21 | 39.99272 |
| 55 | 9 | 1 | 2 | 22 | 43.39228 |
| 60 | 17 | 10 | 1 | 23 | 46.99582 |
| 66 | 15 | 3 | 2 | 24 | 50.81557 |
| 73 | 2 | 1 | 1 | 25 | 54.86451 |
| 79 | 19 | 1 | 0 | 26 | 59.15638 |
| 87 | 7 | 0 | 0 | 27 | 63.70576 |
| 95 | 6 | 1 | 2 | 28 | 68.52810 |
| 113 | 19 | 3 | 3 | 29 | 73.63979 |
| 11 | 5 | 7 | 3 | 30 | 79.05818 |

*yeeres. at 6 p Cent.*

1. 1. 1.00000
2. 2. 2.06000
3. 3. 3.18360
4. 4. 4.37461
5. 5. 5.63709
6. 6. 6.97531
7. 8. 8.39383
8. 9. 9.89746
9. 11. 11.49131
10. 13. 13.18079
11. 14. 14.97164
12. 16. 16.86994
13. 18. 18.88213
14. 21. 21.01506
15. 23. 23.27596

## The vſe of the *ſecond Table* (whoſe diſpoſition is altogether like the former) according to the title thereof, being *profitable*.

### 1 Example.

*There is a Leaſe worth* 28 li. per annum, *to endure* 14 *yeares, I demand what it will riſe vnto at the end of theſe yeares, being all forborne with the intereſt, and intereſt vpon intereſt at the rate preſcribed in this Table.*

Looke in the *third Table* for 14 *yeares*, againſt which toward the right hand, you ſhall finde 24 li—4 ſ—3 d—2 q. Now multiply 28 li by 24 there ariſeth 672 li. then 28 li. by 4 ſ yeeldeth 112 ſ. or 5 l–2 ſ. Againe 28 li by 3 d. produceth 84 d. or 7 ſ. finally, 28 by 2 *farthings* yeeldeth 56 *farthings* or 1 ſ—2 d. All which added together make 678 li—0 ſ—2 d. to be receiued at the end of 14 *yeares*, the ſame *rent* or *annuity* being reſpited.

| li | ſ—d—q |
|---|---|
| 672 | —0—0—0 |
| 5 | —12—0—0 |
| | 7—0—0 |
| | 1—2—0 |
| 678 | —0—2—0 |

2 Exam-

## 2 Example.

*If* 60 li *yearely rent or annuity bee forborne* 20 *yeares. I demand how much it will increaſe at the end of the ſaid terme?*

In the Table I finde that 1 pound in 20 *yeares* will ãriſe to 45 li—15 ſ—2 d—3 q. therefore 60 li. in the like terme will yeeld 60 times as much; which I will reckon thus:

| | li | ſ | d | q |
|---|---|---|---|---|
| 60 times 45 li. is | 2700 | —0 | —0 | —0 |
| 2700 li. 60 times | 45 | —0 | —0 | —0 |
| 15 ſ is 900 ſ. or 45 l. | | 10 | —0 | —0 |
| 60 times 2 d. is | | 3 | —9 | —0 |
| 120 d. or 10 ſ. laſt of all, 60 times 3 q is | 2745 | —13 | —9 | —0 |

180 *farthings*, or 3 ſ —2 d. all which together amount vnto 2745 li—13 ſ—9 d. the value thereof to be receiued at the end of the terme.

## 3 Example.

*The yearely rent of* li—13 ſ—4 d. *being behinde and vnpayd the ſpace of* 7 *yeares, at the end of which terme the Tenant is compelled to pay the ſame with the intereſt thereof according to the above named rate: I demand what the payment ought to be?*

The

The increaſe of 1 li *yearely rent* anſwering to 7 *yeares*, is 8 li–18 ſ–5 d.–1 q. which for 6 li *rent* is to bee taken 6 times, which ariſeth to 53 li–10 ſ—7 d—1 q. now becauſe 13 ſ—4 d. is two third parts of 1 li. therefore I take ⅔ of 8 li—18 ſ—5 d—1 q, which is the increaſe of 1 li. forborne for 7 *yeares*, that is 5 li—18 ſ—11 d—2 q, which together make 59 li—9 ſ—6 d—3 q, the *ſumme* to bee receiued, as was required.

| li | ſ | d | q |
|---|---|---|---|
| 35 | 10 | 7 | q |
| 5 | 18 | 11 | 2 |
| 59 | 9 | 6 | 3 |

The

*The third Table declaring what one pound due at the end of any number of yeares vnder 31 is worth ready money at* 8 per centum, per annum.

| 6. p Cent. | yeeres. | li | ſ | d | q | li. | ſ | d. | q | yeares. | at 6. p Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ·943396 | 1 | 0 | 18 | 7 | 0 | 0 | 5 | 10 | 0 | 16 | ·393646 |
| ·889996 | 2 | 0 | 17 | 10 | 3 | 0 | 5 | 4 | 3 | 17 | ·371364 |
| 839619 | 3 | 0 | 15 | 1 | 2 | 0 | 5 | 0 | 0 | 18 | ·350343 |
| 792093 | 4 | 0 | 14 | 8 | 1 | 0 | 4 | 7 | 2 | 19 | ·330512 |
| 747258 | 5 | 0 | 13 | 7 | 1 | 0 | 4 | 3 | 1 | 20 | ·311804 |
| 704960 | 6 | 0 | 12 | 7 | 0 | 0 | 3 | 11 | 2 | 21 | ·294155 |
| 665057 | 7 | 0 | 11 | 8 | 0 | 0 | 3 | 8 | 0 | 22 | ·277505 |
| 627412 | 8 | 0 | 10 | 9 | 2 | 0 | 3 | 4 | 3 | 23 | ·261797 |
| 591898 | 9 | 0 | 10 | 0 | 0 | 0 | 3 | 1 | 3 | 24 | ·246978 |
| 558394 | 10 | 0 | 9 | 3 | 0 | 0 | 2 | 11 | 0 | 25 | ·232998 |
| 526787 | 11 | 0 | 8 | 6 | 3 | 0 | 2 | 8 | 1 | 26 | ·219810 |
| 496989 | 12 | 0 | 7 | 11 | 1 | 0 | 2 | 6 | 0 | 27 | ·207367 |
| 468839 | 13 | 0 | 7 | 4 | 0 | 0 | 2 | 3 | 3 | 28 | ·195630 |
| 442300 | 14 | 0 | 6 | 9 | 2 | 0 | 2 | 1 | 3 | 29 | ·184556 |
| 417265 | 15 | 0 | 6 | 3 | 2 | 0 | 1 | 11 | 3 | 30 | ·174110 |

This *third Table* is diſpoſed as the *firſt*, the vſe according to the *title* thereof, being *damageable*.

## 1 Example.

*Suppoſe there is* 750 li *due to be payed at the end of* 9 *yeares, the Creditour would ſell this debt for preſent money, what ought that money to bee at the rate deſcribed in the table.*

Seeke in this *third Table* for 9 *yeares* at the *left ſide* of the *Table*, and right againſt it toward the right hand, you ſhall finde 10 *ſhillings*, which multiplied or taken 750 times, yeeldeth 7500 *ſhillings*, which is 375 li. the value of that *debt* in preſent *money*.

## 2 Example.

*There is a Leaſe worth* 500 li. *after the end of* 7 *yeares; what is it worth preſent money, according to the rate deſcribed in the table ſtaying till it fall.*

I ſeeke in the *Table* for the 7 *yeare*, and right againſt it I finde 11 ſ——8 d; now I multiply 500 by 11, it yeeldeth 5500 *ſhillings*, or 275 li. then 500 times 8 d. maketh 4000 d, which is 16 li——13 ſ——4 d, which added together is 291 li——13 ſ——4 d. the value of the *Leaſe* to be payed before it fall in hand.

| li | ſ | d | o |
|---|---|---|---|
| 275 | —0 | —0 | —0 |
| 16 | -13- | —4 | —0 |
| 221 | -13 | —4 | —0 |

*The fourth Table expressing what one pound yearely rent or annuity for any number of yeares not exceeding* 30, *is worth ready money at* 8 per centum, per annum.

| 8. R 6. | yeeres | li | s | d | q | li | s | d | q | yeeres |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.92592 | 1 | 0 | 18 | 6 | 0 | 8 | 17 | 0 | 1 | 16 |
| 1.78326 | 2 | 1 | 15 | 7 | 3 | 9 | 2 | 5 | 0 | 17 |
| 2.57709 | 3 | 2 | 11 | 6 | 2 | 9 | 7 | 5 | 1 | 18 |
| 3.31212 | 4 | 3 | 6 | 2 | 3 | 9 | 12 | 0 | 3 | 19 |
| 3.99271 | 5 | 3 | 19 | 10 | 1 | 9 | 16 | 4 | 1 | 20 |
| 4.62287 | 6 | 4 | 12 | 5 | 1 | 10 | 0 | 4 | 0 | 21 |
| 5.20637 | 7 | 5 | 4 | 1 | 2 | 10 | 4 | 0 | 0 | 22 |
| 5.74663 | 8 | 5 | 14 | 11 | 0 | 10 | 7 | 5 | 0 | 23 |
| 6.24688 | 9 | 6 | 4 | 11 | 1 | 10 | 10 | 6 | 3 | 24 |
| 6.71008 | 10 | 6 | 14 | 2 | 1 | 10 | 13 | 5 | 3 | 25 |
| 7.13896 | 11 | 7 | 2 | 9 | 1 | 10 | 19 | 2 | 1 | 26 |
| 7.53607 | 12 | 7 | 10 | 8 | 2 | 10 | 18 | 8 | 1 | 27 |
| 7.90377 | 13 | 7 | 18 | 0 | 3 | 11 | 1 | 0 | 0 | 28 |
| 8.24423 | 14 | 8 | 4 | 10 | 2 | 11 | 3 | 2 | 0 | 29 |
| 8.55947 | 15 | 8 | 11 | 2 | 1 | 11 | 5 | 1 | 3 | 30 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 10.10589 | 4.71224 | 8.38384 | 12 | 7.88687 | 11 | 6. 80769 | 10 | 5.96008 | 9 |
| 17 | 10.47725 | 4.24498 | 8.85268 | 13 | 8.24214 | 12 | 6.20637 | 9 | 5.74663 | 8 |
| 18 | 10.82760 | 4.77463 | 8.31255 | 14 | 8.55948 | 13 | 6.71008 | 10 | 6.24688 | 9 |
| 19 | 11.15811 | 4.31524 | 8.87487 | 15 | 8.85137 | 14 | 7.13896 | 11 | 6.62287 | 10 |
| 20 | 11.46992 | 4.84350 | 8.35365 | 16 | 9.12164 | 15 | 7.53607 | 12 | 7.20637 | 11 |
| 21 | 11.76407 | 4.37050 | 8.81222 | 17 | 9.37189 | 16 | 7.90377 | 13 | 7.74663 | 12 |
| 22 | 12.04158 | 4.89663 | 8.29676 | 18 | 9.60360 | 17 | 8.24423 | 14 | 8.24688 | 13 |
| 23 | 12.30337 | 4.42226 | 8.77154 | 19 | 9.81815 | 18 | 8.55948 | 15 | 8.71008 | 14 |
| 24 | 12.55035 | 4.94932 | 8.25318 | 20 | 10.01680 | 19 | 8.85137 | 16 | 9.13896 | 15 |
| 25 | 12.78336 | 4.47682 | 8.73715 | 21 | 10.20074 | 20 | 9.12164 | 17 | 9.53607 | 16 |
| 26 | 13.00316 | 4.99660 | 8.21053 | 22 | 10.37106 | 21 | 9.37189 | 18 | 9.90377 | 17 |
| 27 | 13.21053 | 4.52727 | 8.68300 | 23 | 10.52876 | 22 | 9.60360 | 19 | 10.24423 | 18 |
| 28 | 13.40616 | 4.05882 | 8.15506 | 24 | 10.67478 | 23 | 9.81815 | 20 | 10.55948 | 19 |
| 29 | 13.59072 | 4.58823 | 8.62686 | 25 | 10.80998 | 24 | 10.01680 | 21 | 10.85137 | 20 |
| 30 | 13.76482 | 4.11764 | 8.09838 | 26 | 10.93516 | 25 | 10.20074 | 22 | 11.12164 | 21 |
| | | 4.64705 | 8.56960 | 27 | 11.05108 | 26 | 10.37106 | 23 | 11.37189 | 22 |
| | | 4.17647 | 8.04082 | 28 | 11.15841 | 27 | 10.52876 | 24 | 11.60360 | 23 |
| | | 4.70588 | 8.51190 | 29 | 11.25778 | 28 | 10.67478 | 25 | 11.81815 | 24 |
| | | 4.23529 | 8.98273 | 30 | 11.34980 | 29 | 10.80998 | 26 | 12.01680 | 25 |
| | | | | | | 30 | 10.93516 | 27 | 12.20074 | 26 |
| | | | | | | | 11.05108 | 28 | 12.37106 | 27 |
| | | | | | | | 11.15841 | 29 | 12.52876 | 28 |
| | | | | | | | 11.25778 | 30 | 12.67478 | 29 |
| | | | | | | | | | 12.80998 | 30 |

The *fourth Table* is diſpoſed altogether as the former, and the vſe thereof in like ſort being *damageable.*

## 1 Example.

*There is an annuity or rent of* 20 *ſ.* per annum, *to endure* 25 *yeares, it is required what it is worth ready money?*

Looke in the *Table* for the 25 *yeare,* and right againſt it you ſhall finde 10 li—13 ſ—5 d—3 q. which is the ſolution.

## 2 Example.

*What is the leaſe of certaine land valued at* 140 li. per annum, *to begin preſently and endure* 18 *yeares, worth ready money?*

Search in the *Table* for 18 *yeares,* the *terme* named in the *queſtion,* and right againſt it toward the left hand you ſhall finde 9 l—7 ſ. 5 d—1 q. which expreſſeth that *one pound rent* to bee bought for that *terme* is worth ſo much; therefore that ſumme 140 times is

the value required; Now 140 times 9 li is 1260, and 140 times 7 ſ is 980 ſ or 49 li; likewiſe 140 times 5 d is 700 d or 2 li —18 ſ—4 d. and 140 *farthings* is 2 ſ—11 d. all which added together make 1312 li—1 ſ 3 d. for the value of the ſaid *leaſe*, paying no *rent*.

| li | ſ | d |
|---|---|---|
| 1260 | —0 | —0 |
| 49 | —0 | —0 |
| 2 | —18 | —4 |
| 2 | —11 | |
| 1312 | —1 | —3 |

## 3 Example.

*A leaſe taken for* 21 *yeares at* 13 li—6 ſ 8 d per annum, *which after* 5 *yeares expired, the tenant is deſirous to give a fyne, and bring the rent downe to* 8 li per annum *for the reſt of the terme: the demand is what fyne is to be payed?*

Subtract 5 *yeares* from 21, the remaine 16, is the time vnexpired; likewiſe from the preſent *rent* abate 8 li, the reſt will be 5 li–6 ſ–8 d. now the driſt of the *queſtion* is, what 5 li—6 ſ –8 d. *yearly rent or annuity* to endure 16 yeares is worth preſent money?

The value of 1 li *rent or annuity* anſwering to 16 *yeares* is 8 li—17 ſ—0 d—1 q. Now

5

5 times 8 li. is 40 li. and 5 times 17 ſ. is 4 li. —5 ſ. and 5 times one *farthing*, is 1 d. —1 q. and becauſe 6 ſ.—8 d. is $\frac{1}{3}$ of 1 li. I take $\frac{1}{3}$ of 8 li.—17 ſ. —0 d.—1 q. which is 2 li.–19 ſ.—0 d. all which added together, make 4 li.–4 ſ.–1 d.–0 q. which is the *fyne* that ought to bee paid to bring the *rent* to 8 li. *per annum*.

| li | ſ | d | q |
|---|---|---|---|
| 40 | 0 | 0 | 0 |
| 4 | 5 | 0 | 0 |
| 2 | 19 | 1 | 1 |
| 47 | 4 | 1 | 1 |

*The fifth Table declaring what yearely rent or annuity one pound ready money shall purchase for any number of yeares under 31, at 8 per centum, per annum.*

| at 6 per Cent. | yeeres. | li | s | d | q | li. | s. | d. | q | yeares. |
|---|---|---|---|---|---|---|---|---|---|---|
| .96000 | 1 | 1 | 1 | 7 | 0 | | 2 | 9 | 3 | 16 |
| .54543 | 2 | | 14 | 0 | 0 | | 2 | 8 | 3 | 17 |
| .37411 | 3 | | 9 | 8 | 2 | | 2 | 8 | 0 | 18 |
| .28859 | 4 | | 7 | 6 | 2 | | 2 | 7 | 0 | 19 |
| .23739 | 5 | | 6 | 3 | 0 | | 2 | 6 | 2 | 20 |
| .20336 | 6 | | 5 | 4 | 3 | | 2 | 5 | 3 | 21 |
| .17913 | 7 | | 4 | 9 | 2 | | 2 | 5 | 1 | 22 |
| .16103 | 8 | | 4 | 4 | 0 | | 2 | 4 | 3 | 23 |
| .14702 | 9 | | 4 | 0 | 0 | | 2 | 4 | 1 | 24 |
| .13586 | 10 | | 3 | 8 | 2 | | 2 | 4 | 0 | 25 |
| .12679 | 11 | | 3 | 6 | 0 | | 2 | 3 | 3 | 26 |
| .11927 | 12 | | 3 | 3 | 3 | | 2 | 3 | 1 | 27 |
| .11296 | 13 | | 3 | 1 | 3 | | 2 | 3 | 0 | 28 |
| .10758 | 14 | | 3 | 0 | 1 | | 2 | 2 | 3 | 29 |
| .10296 | 15 | | 2 | 11 | 0 | | 2 | 2 | 2 | 30 |

| yeares. | at 6 per Cent. |
|---|---|
| 16. | .09895 |
| 17. | .09544 |
| 18. | .09232 |
| 19. | .08962 |
| 20. | .08718 |
| 21. | .08500 |
| 22. | .08304 |
| 23. | .08127 |
| 24. | .07967 |
| 25. | .07822 |
| 26. | .07690 |
| 27. | .07569 |
| 28. | .07457 |
| 29. | .07357 |
| 30. | .07264 |

In the fifth *Table* the *numbers* and *columnes* are all disposed as the former *Tables*, and needeth no further explanation but onely *Examples*.

## 1 Example.

*The Table declareth at first sight what yearly rent or annuity one pound ready money will purchase for any terme in the Table expressed.*

But if the *ready money* be aboue one pound, then if any *value or rent* set downe in this *Table*, be multiplyed by the *number* belonging to the *yeares in question*, the *product* will shew what *yearly rent or annuity* that *ready money* will purchase for the *time proposed*.

## 2 Example.

*A certaine man hath 750 li. to purchase an annuity to endure 27 yeares, so as it may yeeld him the like profit, as if it were put out according to the rate in the Table expressed, it is required what that annuity ought to be.*

Because

Becauſe the *annuity* is to endure 27 *yeares*, ſeeke out the *value or rent* ſet againſt 27 *yeares* in this *fift Table*, which is 2 ſ—3 d—1 q; now this being the *annuity* 20 ſ. *ready money* will *purchaſe* for that *terme*, it muſt bee multiplyed by 750 li as followeth: becauſe 2 ſ is the tenth part of 20 ſ. therefore take the tenth part of 750 li. which is 75 li. which ſet firſt downe, then 750 times 3 d. is 9 li—7 ſ—6 d, which ſet vnder the former, laſt of all 750 *farthings* is 15 ſ—7 d—ob. All which added together, produce 85 li—3 ſ—1 d—ob. the *yearely annuity* required.

| li | ſ | d | q |
|---|---|---|---|
| 75 | —0 | —0 | —0 |
| 9 | —7 | —6 | —0 |
| | 15 | —7 | —2 |
| 85 | —3 | —1 | —2 |

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*Deo ſoli laus omnis honor & gloria tribuatur. Amen.*

FINIS.

# Arts Mathematicall.

In Great Saint *Bartholomewes* in the new ſtreet, is taught by *Robert Hartwell* Practitioner in the Mathematicks, the *Arts*, *Sciences*, and *Faculties* here-under expreſſed.

viz.

- **Arithmeticke.**
  - IN whole Numbers and Fractions.
  - The Extraction of Roots, viz. { Square, Cube, Squared ſquare, Surſolid. } At one operation.
  - Of Aſtronomicall or Phyſicall Fractions.
  - Of proportion.
  - The Rules of Aequation, with Coſſe, or Algebra.
- **Geometry**
  - Principles with practiſe and Demonſtration.
  - Meaſuring of Land, and reducing of Plots or Maps to any proportion.
  - Plotting of countries with diuets and ſundry inſtruments.
  - Meaſuring of any ſuperficiall or ſolid content. { Board, Glaſſe, &c. Timber, Stone, &c.
- **The doctrine of Triangles.** { Plaine and Sphericall. } With the vſe of the Tables of { Sines, Tangents, Secants, and Logarithmes
- **Deſcription, Demonſtration, and vſe of Inſtruments, viz.** { Quadrant, Quadrat, Theodelite, plaine Table, Circumferenter, Pantometer, Circular Scale, M. Gunters Sector and proportionall Ruler (by him) conuerted into a Croſſe Staffe for Sea-mens vſe.
- **Nauigation.** { Principles thereof, with the making and vſe of ſundry inſtruments fitting that Art. The vſe and proiection of Maps and Charts.
- **Vſe & demonſtration of** { The Sphere or Globe } both { Terreſtiall, and Cœleſtiall. Cœleſtiall Globe in plain, by M. D. Hood. All ſorts of Aſtrolabes, and M. Blagraues Iewell.
- ***Dialling* of all ſorts, *viz.*** { Fixed, and Inſtrumentall. } aſwell { Geometrically, Arithmetically, as Inſtrumentally.
- **Accompts for** { Merchants by order of Debitor & Creditor. Retayle of all ſorts.
- Perfecting of Accompts in Controuerſie.

*Fide* *ſed* *Vide.*

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Syn.8.63.65

# THE GROVND OF ARTS.

TEACHING THE PERFECT worke and practise of Arithmeticke, both in whole Numbers and Fractions, after a more easie and exact forme then in former time hath beene set forth: Made by M. ROBERT RECORD D. in *Physick*.

*Afterward, augmented by* Mr. Iohn Dee.

And since enlarged with a Third part of Rules of Practise, abridged into a briefer method then hitherto hath beene published, with diuers necessary Rules incident to the Trade of Merchandise: with Tables of the valuation of all Coynes, as they are current at this present time: *By* IOHN MELLIS.

And now diligently perused, corrected, illustrated and enlarged; with an *Appendix* of figurate Numbers, and the Extraction of their Roots, according to the Method of *Christian Vrsitius*: with Tables of Board and Timber measure; and new Tables of *Interest* vpon *Interest*, after 10 and 8 *per* 100; with the true value of Annuities to be bought or sold present, Reuersion: the first calculated by *R. C.* but corrected, and the latter diligently calculated by *Robert Hartwell, Philomathemat.*

*Scientia non habet inimicum nisi ignorantem.*

Fide——sed——Vide.

Syn.8.63.65

LONDON,
Printed by THO. HARPER, for *Iohn Harison*, and are to be sold at his shop in Pater noster Row, at the signe of the Vnicorn. 1632.

THat which my friend hath well begun,
For very loue to Common weale,
Need not all whole to be new done,
But new encreaſe I doe reueale.

Something herein I once redreſt,
And now againe for thy behooſe,
Of zeale I doe, and at requeſt,
Both mend and adde, fit for all prooſe.

Of numbers vſe, the endleſſe might,
No wit nor language can expreſſe,
Apply and try both day and night,
And then this truth thou wilt confeſſe.

I. Dee.

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## The Bookes Verdict.

TO pleaſe or diſpleaſe ſure I am,
But not of one ſort to euery man.
To pleaſe the beſt ſort would I faine,
The froward diſpleaſe ſhall I certaine.
Yet wiſh I will, though not with hope,
All gentle or mon.bes to pleaſe or ſtoppe.

23; 02

# TO THE MOST mighty Prince *Edward* the sixth, by the grace of God, King of *England*, *France*, and *Ireland*, &c.



THE Excellency of mans nature being such, as it is by Gods diuine fauour (most mighty Prince) not only created in highnesse of degree farre aboue all other corporall things, but by perfection, reason and search of wit, much approaching toward the Image of God, as not onely the holy Scriptures do testifie, but also those naturall Philosophers, which exactly did consider the nature of man, and namely the far reach and infinite compasse of the works of the minde, were inforced to confesse, that man scarsely was able to know himselfe. And if he would duely ponder the nature of himselfe, he would find it so strange, that it might seeme vnto him a very miracle. And thereof sprang that saying: *Magnum miraculum est homo, maximum miraculum sapiens homo.* For vndoubtedly, as man is one of the greatest miracles that euer God wrought, so a wise man is plainly the greatest.

And therefore was it that some did account the head of a man the greatest miracle in the world, because not onely of the strange workmanship that is in it, but much more of the efficacie of reason, wit, memory, imagination, and such other powers, and workes of the minde, which can more easily conceiue any thing in a manner, then vnderstand it selfe. Amongst all the creatures of God, it findeth none more difficult to be perceiued then these same powers of it selfe; whereby it doth conceiue and iudge: as it may be well coniectured by the diuersity of opinions, that the wisest Philosophers did vtter touching the spirit of man, & the substance of it: whereof, I now intend to make no rehearsall; but whoso listeth to

and it maketh 60, which is your *diuiſor*.

Then the *reduction* of the ſecond number, which is 5, *multiplied* by 117 the product of the laſt *numbers* reduction, make 585, which 585 yet reſteth to be *multiplied* by 2 the *denominator* of the Fraction in the firſt place, yeeldeth 1170, which diuided by your *Diuiſor*, 60, yeeldeth 19 pound, 10 ſ. as appeareth by the worke thereof.

Thus hauing now touched the 12 queſtions whereof I firſt pretended, which with diligence and oft practiſe, *I* truſt are ſufficient to aide the deſirous vnto the working of any broken numbers, I will now intreate of diuers neceſſary Rules incident vnto trafficke, as hereafter followeth.

## The 4 Chapter treateth of Loſſe and gaine in the Trade of Merchandiſe.

IF one yard coſt 6 ſ—8 d. and the ſame is ſold againe for 8 ſ—6 d. the queſtion is, what is gained in 100 pounds laying out on ſuch commodities?

*Anſwer.* The Rule of three direct, applied two manner of wayes to do the ſame: the one is to ſay, If $6\frac{1}{3}$ giue $8\frac{1}{3}$, what gaineth 100? *Multiply* and diuide, and looke what your quotient bringeth foorth aboue your laying out, is the neate gaines, and ſolution

ſo

to your queſtion: If you follow the worke, your ſolution will bring forth 127 li.—10 ſ. which is 27 li. 10 ſ. more then your principall, and ſo much is gained in the 100 pounds laying out.

Item, to work it the other way, which I take the neareſt, ſeeke the difference betwixt the firſt price and the other price, which is one ſhilling 10 pence; then ſay by the rule of three: If 6 $\frac{1}{3}$ ſ. gaine 1 $\frac{2}{3}$ ſ. what ſhall 100 li. gaine? *Multiply* and diuide, and you ſhall finde 27 li. 10 ſ. and ſo much is gained in 100 li. laying out.

You may vſe which of theſe two wayes you thinke good.

## The proofe.

If a yard of Cloth be deliuered for 8 ſ. 6 d. whereupon was gained after the rate of 27 li. 10 ſ. in 100 pounds laying out: The queſtion is, what the yard coſt at the firſt hand?

*Anſwer.* Put your gaine 27 pounds 10 ſ. to 100 pounds, all maketh 127 li—10 ſ. Then ſay, If 127 li. 10 ſ. giue but 100 pound, what giueth 8 $\frac{1}{2}$ ſ? Worke and you ſhall finde 6 ſ—8 d. the true ſolution to your queſtion.

## Yet another Example, or proofe vpon the firſt queſtion.

If one yard coſt 6 ſ 8 d: the queſtion is, what

what price the same is to be sold againe, fo
to gaine 27 li. 10 s. in 100 pounds laying
out?

Answer. *Say by the Rule of three, if* 100 li
*gaine* 127 li–10 s. *what gaineth* 6 $\frac{2}{3}$ s? *Multiply*
*and diuide, and you shall finde* 8 s. 6 d. *your tru*
*solution.*

If one Ell cost 7 s. 8 d. and be sold again
for 8 s. 6 d. *The question is,* What is gained in
20 pounds laying out in such commodities?

Answer. *Seeke the difference betwixt the in*
*price, and the other price which is* 10 *pence, an*
*then apply the* Rule of three, *as before is taught,*
*saying, if* 7 $\frac{2}{3}$ s *giue* $\frac{5}{6}$ *shillings, what gineth* 20 li?
*Multiply and diuide, and you shall finde* 2 li 3 $\frac{11}{23}$ s.
*and so much is gained in* 20 pound *laying out.*

The proofe also by an example of losse.

A *Merchant hath bought Holland cloth a*
8 s. 6 d. *the* Ell, *which proueth not to hi*
*expectation, whereupon he is content to lose* 2 li. 3
$\frac{11}{23}$ s. *in* 20 *pounds laying out. The question is, what*
*price ought to be made of the Cloth, abating thi*
*losse?*

*Answer.* Do as before in Gaines hath beene
taught, putting 2 li. 3 $\frac{11}{23}$ s. to your 20 pound,
all together maketh 22 li–3 $\frac{14}{23}$. Then say by
the Rule of three, *If* 22 li–3 $\frac{11}{23}$ s. *giue* but 20 li.
what shall come of 8 $\frac{1}{2}$ s? work, and you shall
finde 7 s–8 d. the iust price that the Ell ought

to be sold for after the rate of this losse.

Thus it appeareth euidently, as in company the *Rule* is appliable as well to gaine as losse.

*If* 20 ¼ *yards cost* 26 li ½ 10 ſ. *how ſhall I ſell the ſame againe to gaine* ⅔ *of the principall, or to make of* 3,43 *which is all one.*

*Answer.* By the *Rule of three*, if 3 doe giue 4, what will 36 ½ giue? Multiply and diuide, and you ſhall finde 48 ⅔ li. Then ſay againe, if 20 ¼ yards doe giue 48 ⅔ pounds, as well principall as gaine, what will one yard bee worth at that price? Multiply and diuide, and you ſhall finde 2 li 8 $\frac{16}{241}$ ſ.

*If one Elle of Cloth cost mee* 8 ſ, 8 d, *and afterwards I ſell* 10 ½ *Elles thereof for* 5 li, 13 ſ 4 d, *I would know whether I winne or loſe: and how much vpon the* 100 *pounds of money.*

*Answer.* See firſt at 8 ſ. 8 d, the Elle, what 10 ½ Elles comes to, and you ſhall finde 4 li, 11 ſ, and I ſold the ſame for 5 li- 13 ſ- 4 d. ſo that I did gaine vpon the 10 ½ *Elles* 22 ſhillings 4 pence. Then if you would know how much is gained in 100 pounds, I ſay by the *Rule of three*, If 4 li, 11 ſ did gaine 22 ſ 4 d, what will 100 pounds gaine? Multiply and diuide, and you ſhall finde 24 pound- 10 ſ -10 d $\frac{10}{97}$ and ſo much is gained in the 100 pound of money.

*If* 12 ⅓ *yards cost mee* 11 *pound fiue ſhillings,*

*lings, and I sell the yard againe for 16 shillings, the question is, whether I doe win or lose, and how much in or vpon the pound of money?*

*Answer.* Look what the 12 $\frac{1}{3}$ yards come to at 16 s the yard, and you shall finde 10 pound. But they cost 11 pound 5 shillings. So there is lost vpon the whole 1 li, 5 s. Then to know how much is lost in the pound, say by the rule of 3, if 11 $\frac{1}{4}$ pound doe lose 1 $\frac{1}{4}$ pound, what will 1 pound lose? Multiply and diuide, and you shall finde 2 s 2 d $\frac{2}{11}$, and so much is lost in the pound of money.

*If I sell the 100 weight of any commodity for 4 pound, whereupon I doe lose after 10 pound in the 100 pound, I demand how much I shall lose or gaine in the 100 li? if in case I had sold the same for 4 pound 10 shillings.*

*Answer.* Say, if 90 pound yeeld 100, how much will 4 giue? multiply and diuide, and you shall finde 4 $\frac{4}{9}$. Then say againe, if 4 $\frac{4}{9}$ giue me 4 $\frac{1}{2}$ what will 100 come to? Multiply and diuide, and you shall finde 101 pound $\frac{1}{2}$ which is more then 100 pound by 1 pound 5 shillings: & so much is gained in the 100 pound.

*A Merchant hath sold Currans for the summe of 430 pound, and hee hath gained therein after 10 pound in the 100 pound. The question is to know how much he gained in all.*

*Answer.* Say by the rule of three. If 100 pound doe gaine 10 pound, what will 430 pound gaine? Multiply and diuide, and you shall finde 43, and so much hath he gained in all.

If

*If one yard be worth* 28 ½ *s. for how much shall* 10 *yards be sold to gaine after* 8 li. 6 *s* 8 *d. in the* 100 *pound.*

*Answer.* First adde 8 li—6 *s*–8 *d.* to 100. Then say, if 100 li. do giue 108 ⅓ for principall and gaine, what will 28 ½ *s* principall yeeld? Multiply and diuide, and you shall find 30 ⅞ *s*. Then say againe by the Rule of three, if 1 yard do giue 30 ⅞ *s* (which is as well the principall as the gaine) what shall 10 yards giue? Multiply and diuide, and you shall finde 15 li 8 *s* 9 *d.* And for the same price shall the 10 yards be sold, for to gaine after the rate of 8 li-6 *s*-8 *d.* vpon the 100.

## A branch or proofe out of this Question.

*A Merchant hath sold clothes for* 15 li–8 *s* –9 *d. and he hath gained in the whole, the summe of* 1 li.—3 *s*—9 *d. The question is, to know how much he hath gained in the* 100 *pound?*

*Answer.* To know this, first rebate the gaines from the price, and there will remaine 14 li. 5 *s* 0 *d.* Then say by the rule of three direct, if 14 li. ¼ giue me 1 li. 3 ¾ *s*, what will 100 li. giue? Multiply and diuide, and you shall finde 8 li. 6 *s*-8 *d.* the effect desired, the proofe is apparant in the question before.

## Yet another Branch or Proofe of the firſt Queſtion.

*If* 10 *yards be delinered for* 15 li, 8 ſ, 9 d. *whereupon was gained after the rate of* 8 li, 6 ſ. 8 d. *vpon the* 100 *pound, the queſtion is, what the yard did coſt at the firſt hand.*

*Anſwer.* Firſt, ſay by the Rule of three, if 10 with principall and gaine yeeld 15 li. 8 ¾ ſ. what ſhall 1 yeeld? Multiply and diuide and you ſhall finde 30 ⅞ ſ. Then ſay againe by the rule of three, if 108 ⅓ principall and gaine giue but 100, what ſhall 30 ⅞ ſ. of principall and gaine yeeld? Worke, and you ſhall find 21 ⅓ ſ. And ſo much did the yard coſt at the firſt Penny.

*If one yard coſt* 36 ſ. *how much ſhall* 12 *yards be ſold for to gaine after the rate of* 10 li. *in the* 100?

*Anſwer.* Firſt, ſay, If 100 giue 110 pound principall and gaine, what will 36 ſ. giue? Multiply and diuide, and you ſhall finde 39 ⅗ ſ. Then ſay againe by the Rule of three, If one yard of principall & gaine yeeld 39 ⅗ ſhillings, what ſhall 12 yards gaine? Multiply and diuide, and you ſhall finde 23 li.-15 ⅗ s, which ⅗ ſ. in knowne number, is 2 ⅘ d. And for the ſame price ſhall the 12 yards be ſold, to gaine after the rate of 10 in the 100.

### The proofe.

*If* 12 *yards be ſold for* 23 li.-15-2 ⅘ d, *where-*

*upon*

*upon is gained after* 10 li. *in the* 100. *The queſtion is, what the yard coſt at the firſt penny?*

*Anſwer.* Firſt ſay, if 12 giue 23 li. 15 $\frac{2}{3}$ ſ, what one yard? Multiply and diuide, and you ſhall finde 39 $\frac{1}{3}$ ſ. Then ſay againe by the rule of 3, if 110 pounds giue but 100, what ſhall 39 $\frac{1}{3}$ ſ giue? Worke and you ſhall finde 36 ſ. the iuſt price of the yard at the firſt hand.

*Item, When one Merchant ſelleth wares to another, and he giueth to the buyer* 1 li 6 ſ, 8 d, *vpon the ſcore, or* 20 li: *The queſtion is, How much ſhall the buyer gaine vpon the* 100 *pound after that rate.*

*Anſwer.* Firſt adde 1 li-6 ſ-8 d, vnto 20 li, and they are 21 $\frac{1}{3}$. Then ſay, if 20 pound giue 21 $\frac{1}{3}$ what ſhall 100 giue? Multiply and diuide, and you ſhall finde 106 $\frac{2}{3}$. So the buyer getteth after the rate of 6 $\frac{2}{3}$ li, vpon the 100 pound.

Gentle Reader, other neceſſary queſtions appertaining to Losse and Gaine, you ſhall haue in the eight Chapter of this Treatiſe.

# The fifth Chapter entreateth o
Losse and Gaine vpon time, wrought b
*the double rule of three, or by the Rule com*
posed: which is contained in 4 speciall sele
cted branches or questions of diuers formes,
*each one of them springing from the first*
question, and each one of them also,
being a proose to other, &c.

*IF one yard cost mee* 2 s—8 d.
*ready money, and after I sell th*
*same againe for* 2 s—10 d.
*be paid for it at the end of* 3 m
*neths: the question is, what*
*gaine vpon the* 100 li. in 1
*moneths?*

*Answer.* First say, if 2 ⅔ gaine ⅔, what sha
100 li gaine? Multiply and diuide, and yo
shall finde 6 ¼ li. Then say againe, by the Ru
of three, if three moneths gaine 6 ¼ poun
what shall 12 moneths gaine? Worke, and yo
shall finde 25 li. and so much shall I gaine i
12 moneths after that rate.

Item, you may also worke it all at one wo
king by the first part of the rule of 3 compose
saying, if 2 ⅔ d in three moneths do gaine ⅔ o
shilling (which is 2 d.) what will 100 li. gai

in 12 moneths: which for thy further encouragement the worke of this one example I haue here put downe, to verifie that I affirme in the first part of this *Ground of Arts*, that this rule and so all others, more reioiceth in *Broken* then in *Whole*.

| ſ | *moneths* | ſ | li | mo: |
|---|---|---|---|---|
| 2½ | 3 | ⅙ | 100 | 12 |
| 8 | | 1 | 20 | |
| 3 | 2 | | 2000 | |
| 24 | 7200 | x | 3 | |
| 6 | x4444 ( 500 ( 25 | | 6000 | |
| 144 | x44 200 | | 12 | |
| | x | | 72000 | |

Where the multiplication and the diuision being ended, maketh 25 li your desire.

*If a yard be deliuered for* 2 ſ—10 d, *to be paid at* 3 *moneths, whereupon was gained after the rate of* 25 li *in the* 100 *for* 12 *moneths, the question is now what the yard cost at the first hand?*

*Answer.* First say, if 12 moneths gaine 25 li, what shall three moneths gaine? Worke and you shall finde 6 ¼ li: Then say againe the second time, if 106¼ li, giue but 100, what shall 2½ ſ giue? Worke, and you shall find 2 ſ 8 d, which is the iust price that the yard cost at the first hand.

*If one yard of cloth cost mee* 2 ſ—8 d *ready*

*money, for what terme shall I sell the same againe for 2 s. 10 d. so that I might gaine after the rate of 25 pound vpon the 100 pound in 12 moneths.*

*Answer.* First say, if 2 ⅔ gaine ¼ what shall 100 pound gaine? Multiply and diuide, and you shal finde 6 ¼ pound. Then say againe for the second worke, if 25 pound be come of 12 moneths, what shall come of 6 ¼? Worke, and you shall finde three moneths, the iust terme of time that the cloth ought to be deliuered at 22 s. 10 d, to gaine 25 pound vpon the 100 pound in 12 moneths.

*If one yard cost me 2 s 8 d, ready money, for what price shall I sell the same againe to be paid at the end of three moneths, so that I may gaine after the rate of 25 pound in the 100 pound for 12 moneths.*

*Answer.* First say, if 12 gaine 25 li, what shall 3 moneths gaine? Multiply and diuide, and you shall finde 6 ¼ li. Then say for the second worke, if 100 li. giue 10 6 ¼, what giueth 2 ⅔ ? Worke and you shall finde 2 s. 10 d, and for that price must the yard bee sold to gaine after 25 pound in the 100 pound for twelue moneths.

Many other of these questions I might here haue deliuered, but for feare the Booke would rise to too thicke a volume, and so to make the price so much the dearer, whereby it might not bee so portable to my Country men as I wish it. But these 4 I haue of purpose framed in this order, hauing relation one to another,

assuring

assuring you that what question soeuer may be proposed within the compasse of this Rule you shall finde by one of these 4, to make a solution. And moreouer, diuers others are yet to be deliuered, where the Greditor giueth diuers dayes of payment, which can neuer bee wel wrought, nor yet vnderstood, vnlesse you can first finde by art the iust times that al those payments, how different soeuer they be, ought to be paid at once: whereupon first I thinke good here to giue some instructions into such a rule, for it is the onely aide for the finishing of such questions as hereafter shall follow;

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## The sixth Chapter intreateth of Rules of Payment, which is a right necessary Rule, and one or the chiefest hand-maides *that attendeth vpon buying and selling, &c.*

### Example.

*A Merchant doth owe a summe of money, whereof, the $\frac{1}{3}$ is to be paid at 6 moneths, and the $\frac{1}{2}$ at 8 moneths, & the rest at a yeere If hee would pay all at one payment, the question is, what time ought to bee giuen him.*

*Answer.* I haue omitted the quantity of the

the ſumme, for you ſhall vnderſtand, the Rule is appliable, and yeeldeth a true ſolution to what ſumme ſoeuer ſhall be propoſed: But now for order ſake in teaching, I doe imagine the ſumme to be 60 pounds, whereupon the manner of this worke is to multiply the proportionate part of the money by the time, as in company. Then 20 being the firſt payment, and the $\frac{1}{3}$ of 60, which $\frac{1}{3}$ multiplied in broken numbers by 6, his time of payment maketh $\frac{6}{3}$, which in whole numbers, as appeareth by the example in the operation, maketh two moneth: next 30 which is the $\frac{1}{2}$ multipled by his terme 8, yeelds 4 moneths, then the reſt which is 10 li, muſt needs be abreuiated into the proportion it beareth to 60, which is $\frac{1}{6}$ which $\frac{1}{6}$ multiplied by his time 12 moneths, produceth $\frac{12}{6}$ maketh two moneths All which added together, as appeareth in the operation, maketh eight moneths, which is the iuſt time that all thoſe payments ought to be paid at once.

| | |
|---|---|
| $\frac{1}{3}$ by $\frac{6}{1}$ $\frac{6}{3}$ | 2 Mon: |
| $\frac{1}{2}$ by $\frac{8}{1}$ $\frac{8}{2}$ | 4 Mon: |
| $\frac{1}{6}$ by $\frac{12}{1}$ $\frac{12}{6}$ | 2 Mon: |
| | 8 Mon: |

*A Merchant hath* 800 li *to pay, the* $\frac{1}{6}$ *thereof ready money, the* $\frac{1}{4}$ *at two moneths, the* $\frac{1}{2}$ *at foure moneths, and the reſt at a yeare. The queſtion is, if he would pay all at one payment, what time ought to be giuen him?*

Anſwer.

*Answer.* The ready money is neuer multiplied: then $\frac{1}{4}$ multiplied by two moneths as you did before, maketh $\frac{1}{2}$, then $\frac{1}{3}$ by 4 produceth 2 moneths, as appeareth here in the operation. But now for the rest of the money you cannot multiply it vntill you haue sought what proportion it beareth to 800 pounds. Therefore you must subtract the readie money, the $\frac{1}{4}$ and the $\frac{1}{3}$ out of the principall. The rest will be $66\frac{2}{3}$ li. which you must looke what part it beareth to the principall, which you shall finde to be $\frac{1}{12}$, the same you must also multiply by his time 12 moneths, and it yeeldeth 1 moneth, so all make $3\frac{1}{2}$ moneths, as appeareth in the operation.

| | |
|---|---|
| $\frac{1}{4}$ $\frac{2}{1}$ | |
| $\frac{2}{4}$ | $0\frac{1}{2}$ |
| $\frac{1}{3}$ $\frac{4}{1}$ | |
| $\frac{4}{3}$ | 2 |
| $\frac{1}{12}$ $\frac{12}{1}$ | |
| $\frac{12}{12}$ | 1 |
| | $3\frac{1}{2}$ |

*A Merchant is to pay* 1200 li. *in three termes, that is to wit,* 400 li. *at two weeks, and* 600 li. *at foure moneths: lastly,* 200 li. *at fiue moneths: The question is, in what time they ought to be paied at once?*

*Answer.* Proportionate the parts, and you shall finde that 400 is $\frac{1}{3}$ part, and for 600 you shall finde $\frac{1}{2}$, and likewise 200 is the $\frac{1}{6}$ part, which multiply by their times as before, and you shall haue $\frac{2}{3}$ weeks, more eight weeks, and lastly three $\frac{1}{1}$ weeks, which together maketh twelue weeks, or three moneths your desire.

*A Merchant is to pay* 600 *pound in three termes, whereof* 100 *pound is payed present, more* 300 *pound at twenty dayes, and the rest at fiue moneths,*

*neths, accounting thirty dayes to a moneth. The queſtion is, what time ought theſe payments to bee payed at once.*

*Anſwer.* Worke, and you ſhall finde two moneths.

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## The ſeuenth Chapter intreateth of buying and ſelling in the Trade of Merchandiſe, wherein is taken part readie Money, and diuers dayes of payment giuen for the reſt, & what is won or loſt in the 100 li, *forbearance for* 12 *moneths more or leſſe,* according to the quantity of money, or proportion of time, &c.

*A Merchant hath bought Sattens which coſt eight ſ the yard ready money. And he ſeleth the ſame againe to another man for ten ſ the yard, but he giueth two dayes for the payment, that is to ſay, three moneths for the one halfe, and fiue moneths for the other halfe. The queſtion is to know how much the ſeller doth gaine vpon the* 100 *pound in* 12 *moneths after that rate.*

*Anſwer.* Seeke firſt by the Rules of payment, at what time thoſe two payments ought to be payed at once, and you ſhall finde foure moneths, at which time the ſecond Merchant ought to haue paid the whole entire paiment:

And

And therefore ſay by the firſt part of the Rule of three compoſed: If 8 ſhillings in 4 moneths doe gaine 2 ſ, what will 100 li. gaine in 12 moneths? x

| ſ | m | ſ | li | m. |
|---|---|---|---|---|
| 8 | 4 | 1 | 100 | 12 |
| 4 | | | 20 | |
| 32 | | | 2000 | |
| | | | 2 | |
| | | | 4000 | |
| | | | 12 | |
| | | | 48000 | |

$$x = \frac{48000}{32} = \frac{1500}{2} = 750$$

Multiply and diuide, and you ſhall finde 75 pounds, as appeareth in the example, and ſo much doth the firſt Merchant gaine vpon 100 pounds in 12 moneths.

*A Merchant hath ſold fifty clothes, at 9 ½ li. the peece, to be paid the one ⅓ at foure moneths, the ⅓ at fiue moneths, and the ⅙ at 7 moneths, and the ſellers minde is to take no more but after 8 pounds in the 100 for 12 moneths. The queſtion is now what the firſt Merchant gaineth in the ſale of theſe clothes after that rate.*

*Anſwer.* Firſt looke what the 50 cloathes come to at that price, and you ſhall finde 475 pounds. Then ſecondly, according to your direction in the rules of payment, ſeeke at what time all the payments are to be performed at once. And you ſhall finde 4 ⅚ moneths. Then thirdly ſay by the firſt part of the Rule of three compoſed, If 100 li. in 12 moneths gaine 8 li. what will 475 li. gaine in 4 ⅚ moneths? Worke and you ſhall finde 15 li.

and

and $\frac{11}{16}$ of a pound, which is the neat gaines that the firſt Merchant hath after the rate aforeſaid.

*A Merchant hath bought Holland at 7 ſ 3 d the Ell ready money, and hee ſelleth the ſame againe for 8 ſ 4 d the Ell to be paied $\frac{1}{4}$ part in ready money, more $\frac{1}{3}$ part at 2 moneths, and the reſt at 4 moneths. The queſtion is now to know how much the firſt Merchant doth gaine vpon the 100 pounds in twelue moneths after that rate?*

*Anſwer.* According to the direction deliuered you in the rule of payment, the ready money is not to be multiplied. Then working for the other two payments to finde out the true proportion at what time they ought to be paid at once, you ſhall finde for $\frac{1}{3}$ at two moneths, $\frac{2}{3}$ of a moneth. And the reſt of the money which is $\frac{1}{12}$ multiplied by his terme 4 moneths, yeeldeth $1\frac{1}{3}$ moneths, both which added together make $2\frac{1}{3}$ moneths, the iuſt time that both the payments ought to be performed at once. And therefore ſay by the firſt part of the Rule of 3 compoſed, if $7\frac{1}{4}$ in $2\frac{1}{3}$ moneths doe gaine $\frac{11}{240}$ of a pound, what ſhall 100 pounds gaine in 12 moneths after that rate? worke and you ſhall finde $76\frac{172}{203}$ pounds. And ſo much doth hee gaine vpon 100 pounds in twelue moneths.

*A Merchant hath bought 30 clothes at 6 pounds the peece for ready money. Afterward he ſelleth tenne of them for 7 pound the peece, for three*

*three moneths terme. And the other twenty he selleth for 8 pound the piece for 4 moneths terme. The question is now what hee gaineth vpon 100 pounds in twelue moneth?*

*Answer.* First finde the value of the thirty clothes, which amount to 180 pounds. Secondly, seek what the tenne pieces come to at 7 punds, and what the twenty pieces come to at 80 poũds; the one comes to 70, & the other to 160. both which together make 230, which is 50 pounds more then they cost. Thirdly, as I haue taught you in the Rule of payment, proportionate the first and second prices vnto the proportion they beare vnto 230, the product of their two prices, and you shall find $\frac{7}{23}$ for the first, & $\frac{16}{23}$ for the latter. Then fourthly, multiply those parts by their times, and you shall haue $\frac{21}{23}$ and $\frac{64}{23}$ both which together maketh three whole moneths, and $\frac{16}{23}$ of a moneth, which is the iust time that both those payments ought to be paid at once.

Then say by the first part of the Rule of three composed. If 180 pounds in $3\frac{16}{23}$ moneths do gaine 50 pounds, what shall 100 gaine in twelue moneths? Multiply and diuide, and you shall finde $90\frac{10}{11}$ pound, and so much doth he gaine vpon 100 pounds in twelue moneths.

*A Merchant hath bought cinamon which cost him 9 shillings the pound ready money. The question is now at what price hee ought to sell the 100 weight. To wit, 112 pounds to be paid the $\frac{1}{4}$ at two moneths, and the residue*

at

*at the end of three moneths, ſo that he may gaine after the rate of ten pounds vpon 100 pounds for twelue moneths.*

*Anſwer.* Seeke firſt by the Rules of payment at what terme both the payments ought to be paid at once, where the $\frac{3}{4}$ multiplied by his terme two moneths, maketh $\frac{3}{4}$ moneths.

Likewiſe the next paiment, which is $\frac{3}{4}$ multiplied by his terme three moneths, maketh $2\frac{1}{4}$ moneths, both which added together, maketh $2\frac{3}{4}$ moneths, which is the time, that both the payments ought to be paid at once. Then ſay by the Rule of three, if 12 moneths doe giue mee 10 pounds, what will $2\frac{3}{4}$ moneths giue? Multiply and diuide, and you ſhall finde $2\frac{7}{24}$ pounds. Then ſay againe by the Rule of three, If one pound coſt mee 9 ſ, what will 112 pounds coſt? Multiply and diuide, & you ſhall finde 50 li--8 ſ. Then ſay once againe: If 100 pound doe giue $102\frac{7}{24}$ what will $50\frac{1}{3}$ pounds giue? Multiply and diuide, and you ſhall finde 51 li--11 ſ--$1\frac{1}{3}$ d, and for that price ought I to ſell 112 pound of Cinamon to be paid at the two ſeuerall payments aforeſaid, to gaine thereby after the rate of 10 pounds vpon the 100 pound in twelue moneths.

Briefe

## Briefe Rules for our hundreth waight here at London, which is after 112 pound for the 100.

Item, *who that multiplieth the pence that one pound weight is worth by 7, and diuideth the product by 15, shall finde how many pounds in money 112 pound weight is worth.*

*And contrariwise, he that multiplieth the pounds the 112 pounds weight is worth by 15, and diuideth the product by 7, shall find how many pence is euery the one pounde weight is worth.*

### Example.

At 10 pence the pound weight, what is 112 pounds weight worth?

*Answer.* Multiply 10 by 7, and thereof commeth 70, the which diuided by 15, and you shall find $4\frac{2}{3}$ pounds. And thus the 112 pounds is worth 4 li, 13 s, 4 d, after the rate, of 10 pence the pound aforesaid.

At 6 pounds the 112 pounds weight, what is one pound worth?

*Answer.* Multiply 6 by 15, and thereof commeth 90: the which diuide by 7, and you shall finde $12\frac{6}{7}$ d. So much is one pound worth when the 112 pounds did cost 6 pounds.

## The eight Chapter intreateth of Tares and allowances of Merchandize ſold by weight, and of loſſes and gaines therein, &c.

AT 16 pound the 100 Suttle, what ſhall 895 pound ſuttle bee worth, in giuing 4 pound weight vpon euery 100 for treat?

Anſwer. *Adde 4 vnto 100, and you ſhall haue 104. Then ſay by the Rule of three: If 104 be worth 16 pounds what are 895 pounds worth? Multiply and diuide, and you ſhall finde 237 li, 13 ſ, 10 $\frac{8}{13}$ d, and ſo much ſhall the 895 pounds weight be worth.*

Item, at 3 ſ 4 d the pound weight ſhall 754 $\frac{1}{2}$ pound be worth, in giuing 4 pounds weight vpon euery 100 for treat?

*Anſwer.* See firſt by the rule of three what the 100 pound is worth, ſaying: If one coſt 3 $\frac{1}{3}$ ſ, what 100? Multiply and diuide, and you ſhal finde 16 $\frac{2}{3}$ pounds. Then adde 4 vnto 100, and they are 104? Then ſay againe by the rule of three, if 104 be ſold for 16 $\frac{2}{3}$ pounds, for how much ſhall 754 $\frac{1}{2}$ be ſold for? Multiply and diuide, & you ſhall find 120 li, 18 ſ, 3 $\frac{9}{13}$ d. And for ſo much ſhall the 754 $\frac{1}{2}$ pound bee ſold for at 3 ſ 4 d the li, in giuing 4 vpon the 100?

*Other neceſſary briefe rules there are for the finding of treats, or caſting vp of choſts of Sugar, &c.*

*&c. which for that it is a mystery, I omit: If any lacke instruction that way, they shall finde me ready to pleasure them.*

*Item*, if 100 pounds be worth 36 s 8 d. what shall 860 pounds bee worth in rebating 4 pounds vpon euery 100 for tare and cloffe?

*Answer.* Multiply 860 by 4, and thereof commeth 3440, the which diuide by 100, and you shal haue $34\frac{40}{100}$ pounds, abate $34\frac{40}{100}$ from 860 and there will remaine $825\frac{60}{100}$ pounds. Then, say by the rule of three, If 100 pound coft $36\frac{2}{3}$ s. what will $825\frac{60}{100}$ coft after that rate? Multiply and diuide, and you shall finde 15 li. 1 s $8\frac{16}{30}$ d. And so much shall the 860 coft in rebating 4 pounds vpon euery 100, for tare and cloffe.

Item, *whether doth he lose more that giueth 4 pounds vpon the* 100, *or hee that rebateth 4 pounds vpon the* 100?

*Answer.* First note, that he that giueth 4 pounds on 100, giueth 104 for 100. And he which rebateth 4 pounds vpon the 100, giueth the 100 for 96. Therefore say by the rule of three, If 104 bee deliuered for 100, for how much shall the 100 be deliuered? Multiply and diuide, and you shall find $96\frac{4}{13}$, and he which rebateth 4 in the 100, maketh but 95 pounds of 100, so that he loseth 4 pounds in the 100 and the other which giueth 4 li. vpon the 100 looseth but $3\frac{11}{13}$ pounds vpon the 100. Thus you may see, that he which rebateth 4 pounds

ther, make 762064, which *number* being ſubducted from the *Cube* giuen, there remaineth nothing, whereby I gather that the number giuen is exactly *cubicall*.

*The third ſtep to finde out the ſide is in this manner.*

762
1 6 3 8 7 0 6 4 (2 5 4
75
1875
7500
1200
64
762064

*Behold alſo the example following.*

The third example of the cubick root.

6 1 4 1 2 5 0 0 0 (8 5 0

¶ Another manner of working.

*HItherto the Princely high-way to find out the ſide of the* Cube *hath been declared.*

But there are moreouer certaine other waies alſo bending thereto, and leaning to the ſame principles, whereof this is one.

The ſecond forme.

Hauing found out in the Table of ſimple *Cubes*, the firſt figure repreſenting the ſide of the *Cube* contained, in the number ſtanding vnder the firſt *point* on the left hand, ſet it in the

I

*quotient*

quotient, & ſubduct the particular *Cube* of that figure as you did before: then *ſquare* that figure, and triple that *ſquare* the *product* ſhall be the *Diuiſor*, the firſt *figure* whereof ſhall bee ſet vnder that *figure* which is on the right hād next of all to the *point* (now examined) before going.

2 See how many times the *Diuiſor* is contained in the number written ouer it, and multiply the *Diuiſor* in the *quotient*, and ſubduct the *product* from the *dividend*: yet heere you muſt take heed, that you take not a greater *quotient*, then that the *products* made afterward therby 3 may be ſubducted from the *number* giuen.

The ſubduction being done, triple the firſt *figure* which was ſet in the *quotient*, and adde to the triple the laſt *number* which was ſet in the *quotient* on the right hand of the *product*.

This totall multiplied by the *ſquare* of the 4 *figure* laſt found out, and ſet downe the *product* ſo, that the firſt *figure* thereof toward the right hand may ſtand vnder the *point* next before going on the ſame hand, and finally ſubduct the ſame from the *number* giuen.

As in 804357. The particular *Cube*, namely, 729 being taken from the *number* ſtanding vnder the laſt *period* vpon the left hand, there remaineth 75357, the ſide of that particular *Cube* being 9, I ſet in the *quotient*. Then I *ſquare* that *ſide*, it maketh 81, & triple the *ſquare*, the *product* 243 is my *diuiſor*, which I ſet vnder the giuen *number*, ſo that 3 may ſtand vnder 3 with

The fourth example of the cubick roote.

with this *diuiſor*, diuide the *number* ſtandi
ouer it, you ſhall finde 2 to be conteined in
three times. Therefore I ſet 3 in the *quotien*
& multiply the *diuiſor* by it, the *product* is 72
which being ſubducted from 753, the remai
der 24.

*The induction is thus:*

2
753
8043257 (93
243
729

Moreouer I triple 9, the *product* is 27, b
which on the right hand I ſet 3, the *quotien*
laſt found out, the totall is 273.

This *number* I multiply by 9 the *ſquare* o
the *quotient* laſt found out, the *product* ſhall be
2457, which being ſubducted from the ſupe
riour *number*, there remaineth nothing.

*The induction is thus:*

2 4
8043257 (93
273
9
2457

Another

*Another manner.*

THe *selfe-same worke may be dispatched another way a little differing from the former in this manner.*

The *figure* in the *quotient* being found out by ſubducting the particular *Cube*, and alſo the ſecond *figure* in the quotient being found by diuiſion, let the totall *quotient* be tripled, & let the tripled *number* bee multiplied by the former *figure* in the *quotient*. Then let the *product* be multiplied againe, be the latter *figure* found out, and let a *cipher* be ſet on the right hand of that *product*. Laſt of all, let the *Cube* of the latter *figure* found out, bee adde to this *product*, and let the totall ſumme be ſubducted from the number giuen. As in 373248. The third forme.

*The firſt induction is in this manner,*

30
373 248 (7
343

Moreouer I *ſquare* the *ſide* found out, it maketh 49, and triple the *ſquare*, the *product* is 147, which ſhall be the *diuiſor*, by this I diuide 302, the number written ouer it, the *quotient* is 2. Now I triple the totall *quotient* 72, it maketh 216, and multiply this triple by 7, the former *figure* in the *quotient*, the *product* is 1512. I multiply this *product* alſo by 2, the latter *figure* of the *quotient*, and ſet a *cypher* on the right hand of it, ſo as it maketh 30240, vnto this number laſt of all I adde 8, the *Cube* The fift example.

of the latter *figure* found out, the total is 30248 which being ſubducted from the *figure* aboue it, there remaineth nothing.

*The ſecond indaction is thus.*

30
3 7 3 2 4 8 (72
147
30248

¶ All the *points* of the *number* giuen being examined, if any thing remaine, it ſignifieth the *number* giuen is no *Cube*: wherefore the true *ſide* of it cannot be exactly giuen in *numbers*. Yet if it pleaſe you to ſift out the neereſt *ſide* that may be, by the firſt kinde of reduction of *mixt numbers*, you ſhall reduce the *number* giuen vnto a *cubicall* fraction of a greater *denomination*, and afterward ſeeke out the *cubicall ſide* of that *fraction*.

To finde the neereſt Cubicke roote in a ſurd number.

For example ſake, becauſe 120 is no *Cube*, therefore let it be reduced into ſixty *cubicall* parts, after this manner. Multiply 60 *cubically* in it ſelfe, it maketh 216000, by this being taken for the *denominator* of the *fraction*, multiply 120 the *number* giuen, the *produkt* is 2592000 whoſe *cubicall ſide* is $\frac{137}{60}$ that is $4\frac{11}{71}$ the neereſt to the true *ſide* that can be.

*For the extraction of all ſorts of roots, the table of Logarithmes ſet forth by* Mr. *Briggs are moſt excellent, and ready.*

FINIS.

# A Table of Board and Timber measure, more perfect then euer hath been made; shewing also the Squares between 4 and 37 from quarter to quarter, Calculated by *Ro. Hartwell.*

| Board measure. | Inches and quarters. | Squares. | Timber measure. | Board measure. | Inches and quarters. | Squares. | Timber measure. |
|---|---|---|---|---|---|---|---|
| 36.0.0 | 4 | 16 | 108.0.0 | 16.0.0 | 9 | 81 | 21.3.3 |
| 35.8.8 | 1 | 18 | 96.9.0 | 15.5.6 | 1 | 85 | 20.3.3 |
| 32.0.0 | 2 | 20 | 86.4.0 | 15.1.6 | 2 | 90 | 19.2.0 |
| 30.3.1 | 3 | 22 | 78.5.4 | 14.7.7 | 3 | 95 | 18.1.8 |
| 28.8.0 | 5 | 25 | 69.1.2 | 14.4.0 | 10 | 100 | 17.2.8 |
| 27.4.3 | 1 | 27 | 64.0.0 | 14.0.5 | 1 | 105 | 16.4.6 |
| 26.1.8 | 2 | 30 | 57.6.0 | 13.7.1 | 2 | 110 | 15.7.1 |
| 25.0.4 | 3 | 33 | 52.3.6 | 13.3.9 | 3 | 115 | 15.0.2 |
| 24.0.0 | 6 | 36 | 48.0.0 | 13.0.9 | 11 | 121 | 14.2.8 |
| 23.0.4 | 1 | 39 | 44.3.0 | 12.8.0 | 1 | 126 | 13.7.1 |
| 22.1.5 | 2 | 42 | 41.1.4 | 12.5.2 | 2 | 132 | 13.0.9 |
| 21.3.3 | 3 | 45 | 38.4.1 | 12.2.7 | 3 | 138 | 12.5.2 |
| 20.5.7 | 7 | 49 | 35.2.6 | 12.0.0 | 12 | 144 | 12.0.0 |
| 19.8.6 | 1 | 52 | 33.2.3 | 11.7.5 | 1 | 150 | 11.5.1 |
| 19.2.0 | 2 | 56 | 30.8.6 | 11.5.2 | 2 | 156 | 11.0.7 |
| 18.5.8 | 3 | 60 | 28.8.0 | 11.2.9 | 3 | 162 | 10.6.6 |
| 18.0.0 | 8 | 64 | 27.0.0 | 11.0.7 | 13 | 169 | 10.2.2 |
| 17.4.6 | 1 | 68 | 25.4.1 | 10.8.7 | 1 | 175 | 9.8.7 |
| 16.9.4 | 2 | 72 | 24.0.0 | 10.6.7 | 2 | 182 | 9.4.9 |
| 16.4.6 | 3 | 76 | 22.7.5 | 10.4.7 | 3 | 189 | 9.1.4 |

| Broad measure. | Inches and quarters. | Squares. | Timber measure. | Board measure. | Inches and quarters. | Squares. | Timber measure. |
|---|---|---|---|---|---|---|---|
| 10.2.8 | 1 4 | 169 | 8.8.1 | 6.8.6 | 2 1 | 441 | 3.9.2 |
| 10.1.1 | 1 | 203 | 8.5.1 | 6.7.7 | 1 | 451 | 3.8.2 |
| 9.9.3 | 2 | 210 | 8.2.3 | 6.6.6 | 2 | 462 | 3.7.3 |
| 9.7.6 | 3 | 217 | 7.9.6 | 6.6.1 | 3 | 473 | 3.6.5 |
| 9.6.0 | 1 5 | 225 | 7.6.8 | 6.5.4 | 2 2 | 484 | 3.5.7 |
| 9.4.5 | 1 | 232 | 7.4.3 | 6.4.7 | 1 | 495 | 3.4.9 |
| 9.2.9 | 2 | 240 | 7.2.0 | 6.4.0 | 2 | 506 | 3.4.1 |
| 9.1.4 | 3 | 248 | 6.9.7 | 6.3.3 | 3 | 517 | 3.3.3 |
| 9.0.0 | 1 6 | 256 | 6.7.5 | 6.2.6 | 2 3 | 529 | 3.2.7 |
| 8.8.6 | 1 | 267 | 6.5.4 | 6.1.9 | 1 | 540 | 3.2.0 |
| 8.7.3 | 2 | 272 | 6.3.5 | 6.1.2 | 2 | 552 | 3.1.3 |
| 8.6 0 | 3 | 280 | 6.1.6 | 6.0.6 | 3 | 564 | 3.0.6 |
| 8.4.7 | 1 7 | 289 | 5.9.8 | 6.0.0 | 2 4 | 576 | 3.0.0 |
| 8.3.5 | 1 | 297 | 5.8 1 | 5.9.4 | 1 | 588 | 2.9.4 |
| 8.2.3 | 2 | 306 | 5.6.4 | 5.8.8 | 2 | 600 | 2.8.8 |
| 8 1.1 | 3 | 315 | 5.4.8 | 5.8.2 | 3 | 612 | 2.8.2 |
| 8.0.0 | 1 8 | 324 | 5.3.3 | 5.7.6 | 2 5 | 625 | 2.7.6 |
| 7.8.9 | 1 | 333 | 5.1.8 | 5.7.0 | 1 | 637 | 2.7.1 |
| 7.7.8 | 2 | 342 | 5.0.5 | 5.6.5 | 2 | 650 | 2.6.5 |
| 7.6.8 | 3 | 351 | 4 9.2 | 5.5.8 | 3 | 662 | 2.6.0 |
| 7.5.8 | 1 9 | 361 | 4 7 8 | 5.5.4 | 2 6 | 676 | 2.5.5 |
| 7 4.8 | 1 | 370 | 4.6.7 | 5.4.8 | 1 | 689 | 2.5.0 |
| 7.3.9 | 2 | 380 | 4 5.5 | 5.4.3 | 2 | 702 | 2.4.7 |
| 7.2.9 | 3 | 390 | 4 4.3 | 5.3.8 | 3 | 715 | 2.4.1 |
| 7.2.0 | 2 0 | 400 | 4.3.2 | 5.3.3 | 2 7 | 729 | 2.3.7 |
| 7.1.1 | 1 | 410 | 4.2.1 | 5.2.8 | 1 | 742 | 2.3.2 |
| 7.0.2 | 2 | 420 | 4.1.1 | 5.2.3 | 2 | 756 | 2.2.7 |
| 6.9.3 | 3 | 430 | 4.0.1 | 5.1.8 | 3 | 767 | 2.2.4 |

| Board measu. | Inches and quarters. | | Squares. | Timber measu. | Board measu. | Inches and quarters. | | Squares. | Timber measu. |
|---|---|---|---|---|---|---|---|---|---|
| 5.1.4 | 28 | | 784 | 2.2.0 | 4.3.6 | 33 | | 1089 | 1.5.9 |
| 5.0.9 | | 1 | 798 | 2.1.6 | 4.3.3 | | 1 | 1104 | 1.5.6 |
| 5.0.5 | | 2 | 812 | 2.1.2 | 4.3.0 | | 2 | 1120 | 1.5.4 |
| 5.0.0 | | 3 | 826 | 2.0.9 | 4.2.7 | | 3 | 1136 | 1.5.2 |
| 4.9.6 | 29 | | 841 | 2 0.5 | 4.2.3 | 34 | | 1156 | 1.4.9 |
| 4.9.2 | | 1 | 855 | 2.0.2 | 4.2.0 | | 1 | 1174 | 1.4.7 |
| 4.8.8 | | 2 | 871 | 1.9.8 | 4.1.7 | | 2 | 1190 | 1.4.5 |
| 4.8.4 | | 3 | 885 | 1.9.5 | 4.1.4 | | 3 | 1210 | 1.4.3 |
| 4.8.0 | 30 | | 900 | 1.9.2 | 4.1.1 | 35 | | 1225 | 1.4.1 |
| 4.7.6 | | 1 | 915 | 1.8.9 | 4.0.8 | | 1 | 1237 | 1.4.0 |
| 4.7.2 | | 2 | 930 | 1.8.6 | 4.0.5 | | 2 | 1247 | 1.3.7 |
| 4.6 8 | | 3 | 945 | 1.8.3 | 4.0.3 | | 3 | 1280 | 1.3.5 |
| 4.6.4 | 31 | | 961 | 1.7.9 | 4.0.0 | 36 | | 1296 | 1.3.3 |
| 4.6.1 | | 1 | 974 | 1.7.7 | 3.9.7 | | 1 | 1313 | 1.3.1 |
| 4.5.7 | | 2 | 987 | 1.7.5 | 3.9.4 | | 2 | 1331 | 1.2.9 |
| 4.5.3 | | 3 | 1000 | 1.7.2 | 3.9.1 | | 3 | 1350 | 1.2.8 |
| 4.5.0 | 32 | | 1024 | 1.6.9 | 3.8.9 | 37 | | 1369 | 1.2.6 |
| 4.4.6 | | 1 | 1040 | 1.6.6 | 3.8.7 | | 1 | 1388 | 1.2.4 |
| 4.4.2 | | 2 | 1056 | 1.6.3 | 3.8.4 | | 2 | 1416 | 1.2.2 |
| 4.4.0 | | 3 | 1072 | 1.6.1 | 3.8.2 | | 3 | 1425 | 1.2.0 |

# The vſe of this former Table.

IF vpon a *Scale or Ruler* you diuide one *inch* into 10 *equall parts or primes*, and againe by *diagonals* and *paralell lines*, you ſubdiuide each of them into 10 *equall parts or ſeconds*, with your *compaſſes*, you may take of more exact running meaſure for *board and timber*, then by any other meanes whatſoeuer, and ſo place the ſame, or this *Table* if you will, vpon any *ruler*.

Alſo by meanes of the *columnes of ſquares*, you may readily finde a *ſquare* equall to any *parallelipipedon* or piece of *timber* which is thicker then it is broad. As for example, ſuppoſe a piece of *timber* to bee ten *inches thicke*, and 29 *inches broad*: if I multiply theſe *ſides* one by another, they will produce 290, then ſeeking the *columne of ſquares* for 290, which I finde not; but I finde 280 the neareſt *number* to 290, to ſtand againſt 17: therefore I ſay 17 *inches ſere*, will make a *ſquare* equall to ſuch an vnlike *ſquared piece*: then looking in the *columne of Timber meaſure* againſt 17, you ſhall finde that 5 *inches*, 9 *prime*, or $\frac{9}{10}$, and 8 *ſeconds*, or $\frac{8}{100}$ of an *inch in length* of that piece will make a *foot of timber*.

Likewiſe for *broad meaſure*, you may finde how

how much in *length* of any *breadth* of *board* must be in one *foote*.

By the like meanes suppose *for example* that a *board*, appointed to be measured, is 15 *inches* $\frac{1}{4}$ *broad*, if I desire to know how much in *length* thereof will make a *foote*, I seeke in the *columnes* that stand vnder *vnites and quarters*, for $15\frac{1}{4}$, and also against the same in the *columne* vnder the title of *board measure*, where I finde 9 *inches* 1 *prime or tenth* of an *inch*, and 4 *seconds* or *hundreths* of an *inch* will make a *foote* at that *breadth*: the like may be practised for any other *breadth of board* whatsoeuer.

# Certaine Tables shewing the interest of any *sum of mony* whatsoeuer vnto 40 yeers; How much *Annuities* respited or forborne commeth vnto. And for *buying or selling* of *Annuities* for the said time: and also the same in *reuersion* after any *number* of *yeres* vnto 40. what they may be worth in present ready money, by *R. C.* and now diligently corrected and amended by *Robert Hartwell.*

## Definition of Interest.

PRincipall, *is the summe from which the* Interest *is reckoned.*

2 Interest *is the summe reckoned for the lending or forbearance of the* Principal *for any terms or time.*

3 Interest simple *is that which is counted from the* Principall *onely.*

4 Interest compound, *is that which is counted for the* Principall, *together with the* Arerage.

5 Interest profitable, *is that which is added to the* Principall.

6 Interest damagable, *is that which is to bee subtracted from the* Principall.

| | | | |
|---|---|---|---|
| The vse per annum of | 1 li. | is | 2 s. |
| | 10 s. | | 12 d. |
| | 5 s. | | 6 d. |
| | 2 s. 6 d. | | 3 d. |
| | 12 d. | | 1 d. ; of a penny. |

A

*A Table ſhewing what* 1 l. *with intereſt, and intereſt upon intereſt after* 10 *in the* 100. *comes to every yeare under* 41 *yeeres. As followeth.*

| yeeres. | l | s | d | l | s | d | yeeres. |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 0 | 7 | 8 | 0 | 21 |
| 2 | 1 | 4 | 2 | 8 | 2 | 9 | 22 |
| 3 | 1 | 6 | 7 | 8 | 19 | 1 | 23 |
| 4 | 1 | 9 | 3 | 9 | 16 | 11 | 24 |
| 5 | 1 | 12 | 2 | 10 | 16 | 8 | 25 |
| 6 | 1 | 15 | 5 | 11 | 18 | 4 | 26 |
| 7 | 1 | 18 | 11 | 13 | 2 | 2 | 27 |
| 8 | 2 | 2 | 10 | 14 | 8 | 5 | 28 |
| 9 | 2 | 7 | 1 | 15 | 17 | 3 | 29 |
| 10 | 2 | 11 | 10 | 17 | 8 | 11 | 30 |
| 11 | 2 | 17 | 1 | 19 | 3 | 10 | 31 |
| 12 | 3 | 2 | 9 | 21 | 2 | 3 | 32 |
| 13 | 3 | 9 | 0 | 23 | 4 | 6 | 33 |
| 14 | 3 | 15 | 11 | 25 | 10 | 11 | 34 |
| 15 | 4 | 3 | 6 | 28 | 2 | 0 | 35 |
| 16 | 4 | 11 | 10 | 30 | 18 | 3 | 36 |
| 17 | 5 | 1 | 1 | 34 | 0 | 0 | 37 |
| 18 | 5 | 11 | 2 | 37 | 8 | 1 | 38 |
| 19 | 6 | 2 | 3 | 41 | 2 | 10 | 39 |
| 20 | 6 | 14 | 6 | 45 | 5 | 2 | 40 |

By the former Table, if you desire to know what 1 li. commeth to with *interest*, and *interest* vpon *interest* after 10 in the 100. for any number of yeares vnto 40. Looke in the *rowe of margent* (ouer which is written *yeeres*) and against it on the right hand close vnto it in the *rowe or Margent of pounds, shillings, and pence*, (which is titled thus, li. s. d.) you shall find your desire.

*Example.*

*I would know what* 1 li. *with interest, and interest vpon interest commeth to in* 7 *yeares?*

I looke in the rowe of *yeeres* for the number 7. And against it on the right hand I find 1. li. 18. s. 11. d. Also what it commeth vnto in 13. yeares. I seeke among the yeares for 13. and against it I finde 3. li. — 9 s. Against for 21. yeares, I looke for 21. among the yeares and I finde 7 li. 8. s. 0. d. But if you would know for a greater summe then 1. li. Then multiply your summe by that summe of 1. li. in the Table for any of those yeeres, and you shall easily finde it. As thus, I would know what 10. li. commeth to for 7 yeares with interest, &c. I see that 1. li. commeth to 1. li. 18. 11. d. in that time. Then say I that 10. li. must be 10. times as much in that space, which is 19 li. 9. s. 2. d. Also of 10. li. in 13. yeeres I see that 1. li. in that time commeth vnto 3. li. 9. s. Then must 10. li. bee 10. times as must in that space, which is 34. li. 10. s. Also what 10. li. commeth

mmeth to in 21 yeares. I finde first that 1 in that space commeth to in 7 li. 8 s. Then by 10 must be 10 times as much, which is 4 li. Lastly, I would know what 100 li. commeth to in 7 yeares, I see it must bee 100 mes as much as 1 li. commeth to in that ace, which is 194 li. 11 s. 8 d. Hereby you the common saying is not true, that 100 li. oth double it selfe in 7 yeares, for it wants hereof 5 li. 8 s. 4 d. But in 8 yeares 100 li. ommeth to 210 li. 8 s. 4. d. Which you see is ere then double it self by 10 li. 8 s. 4 d. And this sort may any that can but cast with Counters, or indeed by memory finde the ncrease of any summe whatsoeuer for any of e number of yeares in the foresaid Table, af- r they haue found what 1 li. commeth vnto r that time, as before is specified.

*A Table shewing if* 1 l. *Annuity to endure for a number of yeares, under* 40. *be all respited or forborn vntill the last payment grow due, and then all be recued together: with interest, and interest vpon interest after* 10 *in the* 100 *per annum, what they will amount vnto by any of the said number of yeares. As followeth.* Viz.

| yeares. | l. | s. | d. | l. | s. | d. | yeares. |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 64 | 0 | 0 | 21 |
| 2 | 2 | 2 | 0 | 71 | 8 | 0 | 22 |
| 3 | 3 | 6 | 2 | 79 | 10 | 10 | 23 |
| 4 | 4 | 12 | 10 | 88 | 9 | 11 | 24 |
| 5 | 6 | 2 | 1 | 98 | 6 | 11 | 25 |
| 6 | 7 | 14 | 3 | 109 | 3 | 7 | 26 |
| 7 | 9 | 9 | 8 | 121 | 1 | 11 | 27 |
| 8 | 11 | 8 | 8 | 134 | 4 | 2 | 28 |
| 9 | 13 | 11 | 7 | 148 | 12 | 7 | 29 |
| 10 | 15 | 18 | 8 | 164 | 9 | 10 | 30 |
| 11 | 18 | 10 | 7 | 181 | 18 | 10 | 31 |
| 12 | 21 | 7 | 8 | 201 | 2 | 9 | 32 |
| 13 | 24 | 10 | 5 | 222 | 5 | 0 | 33 |
| 14 | 27 | 19 | 5 | 245 | 9 | 6 | 34 |
| 15 | 31 | 15 | 9 | 271 | 0 | 5 | 35 |
| 16 | 35 | 18 | 11 | 299 | 2 | 6 | 36 |
| 17 | 40 | 10 | 10 | 330 | 0 | 9 | 37 |
| 18 | 45 | 11 | 11 | 364 | 0 | 10 | 38 |
| 19 | 51 | 3 | 2 | 401 | 8 | 11 | 39 |
| 20 | 57 | 0 | 6 | 442 | 11 | 10 | 40 |

By this Table you may know what any Annuitie being reſpited or forborne for any number of yeares vnto 41. with intereſt vpon int. after 10 in the 100 will come vnto: firſt ſeeking in the Table what 1 li. will come vnto in that time, and that being found to multiply it by the ſumme you deſire to know.

*Example.*

*Firſt, I would know what* 1 li. *Annuity, being forborne or reſpited for* 14 *yeares cometh vnto.*

I looke in this laſt Table (which is for purpoſe) and I finde 27 li. 19 ſ. 5 d.

Againe, what 1 li. *Annuity* reſpited for 21 *yeares* commeth to, I looke in the ſaid Table for 21 *yeares*, and I finde 64 li. Alſo the like for 1 li. for 30 *yeares* reſpited. I looke, and I finde it to be 164 li. 9 ſ. 10 d. as by the ſaid Table may appeare. Now for greater *Annuities*, as 30 li. *per annum*, reſpited or forborne, what it amounteth to in 16 *yeares*. I ſeeke firſt for 1 li. in this laſt *Table* before for 16 *yeares*, and againſt it I finde 35 li. 18 ſ. 11 d. Then ſay I, that 30 li. *per annum* being reſpited for that time, will come to 30 times as much, which is 1078 li. 7 ſ. 6 d. Alſo if there be an *Annuitie* of 45 li. due and vnpayed for 12 *yeares*. I looke in the ſaid Table what 1 li. commeth to, 12 yeares being reſpited, and *I* finde it it is 21 li. 7 ſ. 8 d. Then *I* conclude that

5 li.

5 li. must bee 45 times as much, which is 962 li. 5 s.

*Lastly, I haue an Annuitie of* 50 li. *per annum, which hath beene behinde for* 16 *yeares, and must be answered vnto me with interest, and interest vpon interest, all at one payment, what shall or ought I to receiue in all at the* 16 *yeares end?*

I seeke what 1 li. comes vnto in that time (as before taught) and I finde 35 li. 18 s. 11 d. Then must my 50 li. *per annum* forborne for that time, come to 50 times as much, which is 1797 li. 6 s. 10 d. And thus may you finde any other *summe* great or small, for any *number* of *yeares* contained in the foresaid *Table*, without the helpe of *Arithmeticke*, if you can but vse your *Counters*, or by memory count well.

*A Table shewing if* 1 l. *Annuity (to endure for any number of yeares vnto* 41 *) bee to bee sold for present ready money, how much ought that ready money to bee, reckoning* 10. per 100. per annum *abating interest, and interest vpon interest, As followeth.*

| yeares. | l | s | d | | l | s | d | yeares. |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 18 | 2 | | 8 | 12 | 11 | 21 |
| 2 | 1 | 14 | 8 | | 8 | 15 | 5 | 22 |
| 3 | 2 | 9 | 8 | | 8 | 17 | 7 | 23 |
| 4 | 3 | 3 | 4 | | 8 | 19 | 8 | 24 |
| 5 | 3 | 15 | 9 | | 9 | 1 | 6 | 25 |
| 6 | 4 | 7 | 1 | | 9 | 3 | 2 | 26 |
| 7 | 4 | 18 | 4 | | 9 | 4 | 8 | 27 |
| 8 | 5 | 6 | 8 | | 9 | 6 | 1 | 28 |
| 9 | 5 | 15 | 2 | | 9 | 7 | 4 | 29 |
| 10 | 6 | 2 | 10 | | 9 | 8 | 6 | 30 |
| 11 | 6 | 9 | 9 | | 9 | 9 | 7 | 31 |
| 12 | 6 | 16 | 3 | | 9 | 10 | 6 | 32 |
| 13 | 7 | 2 | 0 | | 9 | 11 | 4 | 33 |
| 14 | 7 | 7 | 4 | | 9 | 12 | 2 | 34 |
| 15 | 7 | 12 | 1 | | 9 | 12 | 10 | 35 |
| 16 | 7 | 16 | 5 | | 9 | 13 | 6 | 36 |
| 17 | 8 | 0 | 5 | | 9 | 14 | 1 | 37 |
| 18 | 8 | 4 | 0 | | 9 | 14 | 7 | 38 |
| 19 | 8 | 7 | 3 | | 9 | 15 | 1 | 39 |
| 20 | 8 | 10 | 3 | | 9 | 15 | 6 | 40 |

This Table before last specified is very necessary and commodious for all *Gentlemen* or others, that shall haue cause to buy or sell *Annuities* or such like, for by this they shall know what they doe, whether they demaund, or take too litle or too much, after the rate of 10. in the 100 by which proportion all these *Tables* are ruled.

*As for example, I am to buy an Annuity of* 16. li. per annum *for* 12 *yeeres, and am demanded for it in ready mony* 120. li. *I would know, if I giue this rate, whether I giue too much or too little, according to the proportion of* 10 *in the* 100 *per annum, &c.*

I looke in the *Table* last before what 1 li. is worth for 12. *yeeres*, and I find against 12 this *summe* 6 li. 16. s. 3. d. Now I say that 16. l. *Annuity* for that time, and after that proportion commeth to 16 times as much, which is 100. li. So that I see the party demaunded of mee 11. li. too much after the rate of 10. in the 100 *per annum*, and therefore I must draw him to a lower price, or leaue it.

*Againe, I am offered an Annuity of* 20. li. *per annum of* 14. *yeeres for* 130. li, *I would know if I giue it, whether I giue too much or too little, according to the proportion aforesaid.*

I seeke first what 1. li. *Annuitie* is worth for 14 *yeeres*, and I finde in the said last *Table* 7. l. 7. s. 4. d. Then say that the *Annuity* of 20. li. *per annum*, will come to 20. times as much, & will be worth 147. li. 6. s. 8d. according to the

the proportion before mentioned, and is more then his demand by 17 li. 6 ſ. 8 d. So that I ſee, if I accept of it, I ſhall haue a good *bargaine*. And thus may you know readily by looking in your *Table*, and finding what 1 li. is worth for any time therein contained, how much any greater *ſumme* will come vnto, if you multiply it by that *ſumme* of 1 li. as before is ſufficiently ſhewed.

*But ſuppoſe this: I haue* 300 li. *ready money & would beſtow the ſame for a valuable Annuity anſwerable thereunto according to the proportion aforeſaid. I would know what Annuity to endure* 21 *yeares this* 300 li *will buy?*

I looke in the former *Table* what 1 li. *Annuitie* will coſt for that time, and I finde 8 li. 12 ſ. 11 d. Then I ſay by the *Rule of Proportion*. If 8 li.-12 ſ-11 d. will buy 1 li. *Annuity* for 21 *yeares*: what *Annuity* ſhall 300 li buy or be worth for that time, I reduced the *ſummes* to the leaſt *denomination* (which is *pence*) and I finde 34 li. 10 ſ. 9 d. And after this manner (by the helpe of this *rule*) may you finde all other ſummes for any time contained in the foreſaid laſt *Table*.

*A Table shewing what* 1 *li. in reuersion for a-ny number of yeares vnder* 31 *is worth in ready money, the buyer staying vntill the thing be fallen in hand.*

| yeares. | li. | s | d. | li. | s | d. | yeares. |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 18 | 2 | 0 | 4 | 4 | 16 |
| 2 | 0 | 16 | 6 | 0 | 3 | 11 | 17 |
| 3 | 0 | 15 | 0 | 0 | 3 | 7 | 18 |
| 4 | 0 | 13 | 7 | 0 | 3 | 3 | 19 |
| 5 | 0 | 12 | 5 | 0 | 2 | 11 | 20 |
| 6 | 0 | 11 | 3 | 0 | 2 | 8 | 21 |
| 7 | 0 | 10 | 3 | 0 | 2 | 5 | 22 |
| 8 | 0 | 9 | 3 | 0 | 2 | 2 | 23 |
| 9 | 0 | 8 | 5 | 0 | 2 | 0 | 24 |
| 10 | 0 | 7 | 8 | 0 | 1 | 10 | 25 |
| 11 | 0 | 7 | 0 | 0 | 1 | 8 | 26 |
| 12 | 0 | 6 | 4 | 0 | 1 | 6 | 27 |
| 13 | 0 | 5 | 9 | 0 | 1 | 4 | 28 |
| 14 | 0 | 5 | 3 | 0 | 1 | 3 | 29 |
| 15 | 0 | 4 | 9 | 0 | 1 | 1 | 30 |

This last *Table* differeth, and is contrary to the other three before mentioned. For whereas the others increas'd more and more according to the *number of yeares* specified. This doth grow and diminish lesse and lesse, as the *number of yeares* increaseth. As for *example.*

*There is a Tenement, the fee simple whereof after 7 yeares will bee worth* 40 li. *what am I to giue for it in ready money, now staying vntill it fall in hand.*

To know this, I looke in this last *Table* for 7 *yeares*, and against it I finde 10 s. 3 d. So that a thing that after 7 *yeares* will be worth 1 li. is worth now in ready *money* but 10 s 3 d. Then say I that the foresaid Tenement (which after 7 *yeares* will be worth 40 li.) is now worth 40 times 10 s. 3 d. which is 20 li. 10 s.

*Againe, there is a Farme which after 9 yeares will be worth the fee simple* 420 li. *what is it now worth in ready money staying vntill it fall in hand.*

I looke in the said *Table* what 1 li. is worth in reuersion after 9 *yeares*, and I find 8 s 5 d. Then say I, that the *Farme* of 420 li. so long in reuersion, will bee now worth in readie money, 420 times as much, which is 176 li. 15 s.

*Lastly, there is a Lordship to be sold, the Fee-simple whereof after* 14. *yeares will bee worth* 7500 li. *I would know what the same is now worth in ready money for the Reuersion.*

I looke in this last *Table* for 14 yeares, and against it I finde 5 s. 3 d. so much 1 li. is worth

in reuerſion after 14 yeares. Then ſay I, that 7500 li. is worth no more in reuerſion for that time then 7500 times 5 ſ. 3 d. which is 1968 li. 15 ſ. And after this manner may you finde out any other *ſummes* whatſoeuer. And though ſome men of their owne experience can ayme (as they thinke) neare enough the marke to ſerue their owne turnes: yet I dare vndertake they ſhall neuer ſo exactly doe it nor iuſtifie what they do, as if they did it by Art.

FINIS.

# New *Tables* of *Interest* at 8 *per centum, per annum*, exactly calculated for 30 *yeares* by *Robert Hartwell*, with necessarie *questions* for the vse of them.

*The first Table expressing the increase of one pound principall, put out and forborne for any number of yeares vnder 31, at* 8 per centum, per annum.

| yeares. | li. | ſ | d | q. |
|---|---|---|---|---|
| 1 | 1 | 1 | 7 | 0 |
| 2 | 1 | 3 | 3 | 3 |
| 3 | 1 | 5 | 2 | 1 |
| 4 | 1 | 7 | 2 | 2 |
| 5 | 1 | 9 | 4 | 2 |
| 6 | 1 | 11 | 8 | 3 |
| 7 | 1 | 14 | 3 | 1 |
| 8 | 1 | 17 | 0 | 0 |
| 9 | 1 | 19 | 11 | 3 |
| 10 | 2 | 3 | 2 | 0 |
| 11 | 2 | 6 | 7 | 2 |
| 12 | 2 | 10 | 4 | 1 |
| 13 | 2 | 14 | 4 | 2 |
| 14 | 2 | 18 | 8 | 3 |
| 15 | 3 | 3 | 5 | 1 |

| li. | ſ | d | q. | yeares. |
|---|---|---|---|---|
| 3 | 8 | 6 | 0 | 16 |
| 3 | 14 | 0 | 0 | 17 |
| 3 | 19 | 11 | 0 | 18 |
| 4 | 6 | 3 | 3 | 19 |
| 4 | 13 | 2 | 2 | 20 |
| 5 | 0 | 8 | 0 | 21 |
| 5 | 8 | 8 | 3 | 22 |
| 5 | 17 | 5 | 0 | 23 |
| 6 | 6 | 9 | 3 | 24 |
| 6 | 16 | 11 | 2 | 25 |
| 7 | 7 | 11 | 0 | 26 |
| 7 | 19 | 9 | 0 | 27 |
| 8 | 12 | 6 | 2 | 28 |
| 9 | 6 | 4 | 0 | 29 |
| 10 | 1 | 3 | 0 | 30 |

# The deſcription and vſe of the *Tables* of *Intereſt* at 8 *per* 100. *per annum*, being *profitable*.

## The firſt of them.

THeſe *Tables* conſiſt of foure *Columnes*, in the *firſt* and *fourth* whereof is written ouer the head *yeares*, and vnder the *firſt* the number of *yeares* deſcending from 1 to 15: likewiſe in the *fourth* the number of *yeares* deſcending from 16 to 30. And againſt euery *yeare* in the *ſecond Columne* toward the right hand, the *pounds*, *ſhillings*, *pence* and *farthings*, which one *pound*, or 20 *ſhillings* principall will amount vnto, being put forth and forborne for the number of *yeares* ſet againſt it: (but the *pounds*, *ſhillings*, *pence*, &c. in the third *Columne* belongeth to the *yeares* ſet in the laſt *Columne*.

I Exam-

## 1 Example.

*Let it be required what one pound or* 20 *ſhillings, being put forth and forborne for* 12 *yeares ariſeth to at* 8 per 100, per annum, *intereſt vpon intereſt.*

Seeke in the *firſt Columne* vnder the *title of yeares*, for 12 the number of *yeares* propoſed in the queſtion, and right againſt it toward the right hand in the *ſecond Columne*, you ſhall finde 2 li.—10.—4 d—1 q, which is the *principall* and *increaſe* thereof due for the time required.

## 2 Example.

*If* 100 li. *be put forth for* 17 *yeares according to the ſame intereſt. I demand what it will amount to in that time?*

Looke in the *Columne* vnder the *title* of *yeares* for 17, and right againſt it towards the left hand in the *Table* is found 3 l.—14 ſ.—0 d—0 q, which is the encreaſe of 1 li.

by which you may thus gather the increaſe of 100 li. or any other *ſumme*; a hundreth times 3 li, is 300 li. then 100 times 14 *ſhillings* is 70 li. both which added together doe make 370 li—0 s—0 d. which is the *increaſe* of 100 li put forth and forborne 17 *yeares* the ſolution to the queſtion.

| li | ſ | d | q |
|---|---|---|---|
| 300 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 |
| 370 | 0 | 0 | 0 |

## 3 Example.

*Suppoſe 60 li be put forth for 19 yeares according to that rate, what will it increaſe to in that time?*

Seeke 19 vnder the *title* of *yeares*, and againſt it toward the left hand is found 4 li—6 s-3 d-3 q now ſay 60 times 4 li is 240. and 60 times 6 *ſhillings* is 360 *ſhillings* or 18 li. and 60 times 3 d is 180 d. or 15 *ſhillings*, and 60 times 3 *farthings* is 3 *ſhillings* 9 d. all which added together make 258 li. 18 ſ. 9 d. the increaſe thereof demanded.

| li | ſ | d | q |
|---|---|---|---|
| 240 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 |
| 0 | 15 | 0 | 0 |
| | 3 | 9 | 0 |
| 258 | 18 | 9 | 0 |

The

*The ſecond Table ſhewing what one pound Annuity or yearly rent is worth at the end of any number of yeares vnder 31, being forborne, at 8 per centum, per annum.*

| yeeres. | li | ſ | d | q. |
|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 |
| 2 | 2 | 1 | 7 | 0 |
| 3 | 3 | 4 | 11 | 0 |
| 4 | 4 | 10 | 1 | 1 |
| 5 | 5 | 17 | 3 | 3 |
| 6 | 7 | 6 | 8 | 0 |
| 7 | 8 | 18 | 5 | 1 |
| 8 | 10 | 12 | 8 | 3 |
| 9 | 12 | 9 | 9 | 0 |
| 10 | 14 | 9 | 8 | 3 |
| 11 | 16 | 12 | 10 | 3 |
| 12 | 18 | 19 | 6 | 2 |
| 13 | 21 | 9 | 10 | 3 |
| 14 | 24 | 4 | 3 | 2 |
| 15 | 27 | 3 | 0 | 2 |

| li. | ſ | d | q. | yeeres |
|---|---|---|---|---|
| 30 | 6 | 5 | 3 | 16 |
| 33 | 15 | 0 | 0 | 17 |
| 37 | 9 | 0 | 0 | 18 |
| 41 | 8 | 11 | 0 | 19 |
| 45 | 15 | 2 | 3 | 20 |
| 50 | 8 | 5 | 2 | 21 |
| 55 | 9 | 1 | 2 | 22 |
| 60 | 17 | 10 | 1 | 23 |
| 66 | 15 | 3 | 2 | 24 |
| 73 | 2 | 1 | 1 | 25 |
| 79 | 19 | 1 | 0 | 26 |
| 87 | 7 | 0 | 0 | 27 |
| 95 | 6 | 1 | 2 | 28 |
| 113 | 19 | 3 | 3 | 29 |
| 11 | 5 | 7 | 3 | 30 |

## The vſe of the *ſecond Table* (whoſe diſpoſition is altogether like the former) according to the title thereof, being *profitable*.

### 1 Example.

*There is a Leaſe worth* 28 li. per annum, *to endure* 14 *yeares, I demand what it will riſe vnto at the end of thoſe yeares, being all forborne with the intereſt, and intereſt vpon intereſt at the rate preſcribed in this Table.*

Looke in the *third Table* for 14 *yeares*, againſt which toward the right hand, you ſhall finde 24 li—4 ſ—3 d—2 q. Now multiply 28 li by 24 there ariſeth 672 li. then 28 li. by 4 ſ yeeldeth 112 ſ. or 5 l-12 ſ. Againe 28 li by 3 d. produceth 84 d. or 7 ſ. finally, 28 by 2 *farthings* yeeldeth 56 *farthings* or 1 ſ—2 d. All which added together make 678 li—0 ſ—2 d. to be receiued at the end of 14 *yeares*, the ſame *rent* or *annuity* being reſpited.

| | li | ſ | d | q |
|---|---|---|---|---|
| | 672 | 0 | 0 | 0 |
| | 5 | 12 | 0 | 0 |
| | | 7 | 0 | 0 |
| | | 1 | 2 | 0 |
| | 678 | 0 | 2 | 0 |

2 Exam-

## 2 Example.

*If* 60 li *yearely rent or annuity bee forborne* 20 *yeares. I demand how much is will increaſe at the end of the ſaid terme?*

In the Table I finde that 1 pound in 20 *yeares* will ariſe to 45 li—15 ſ—2 d—3 q. therefore 60 li. in the like terme will yeeld 60 times as much; which I will reckon thus:

| | li | ſ | d | q |
|---|---|---|---|---|
| 60 times 45 li. is | 2700 | —0 | —0 | —0 |
| 2700 li. 60 times | 45 | —0 | —0 | —0 |
| 15 ſ is 900 ſ. or 45 l. | | 10 | —0 | —0 |
| 60 times 2 d. is | | 3 | —9 | —0 |
| 120 d. or 10 ſ. laſt of all, 60 times 3 q is 180 *farthings*, or 3 ſ —2 d. | | | | |
| | 2745 | —13 | —9 | —0 |

all which together amount vnto 2745 li—13 ſ—9 d. the value thereof to be receiued at the end of the terme.

## 3 Example.

*The yearely rent of* li—13 ſ—4 d. *being behinde and vnpayd the ſpace of* 7 *yeares, at the end of which terme the Tenant is compelled to pay the ſame with the intereſt thereof according to the above named rate: I demand what the payment ought to bee?*

The

The increaſe of 1 li *yearely rent* anſwering to 7 *yeares*, is 8 li–18 ſ – 5 d. – 1 q. which for 6 li *rent* is to bee taken 6 times, which ariſeth to 53 li–10 ſ —7 d.—1 q. now becauſe 13 ſ—4 d. is two third parts of 1 li. therefore I take ⅔ of 8 li—18 ſ—5 d—1 q, which is the increaſe of 1 li. forborne for 7 *yeares*, that is 5 li —18 ſ—11 d—2 q, which together make 59 li—9 ſ—6 d—3 q, the *ſumme* to bee receiued, as was required.

| li | ſ | d | q |
|---|---|---|---|
| 35 | 10 | 7 | q |
| 5 | 18 | 11 | 2 |
| 59 | 9 | 6 | 3 |

The

*The third Table declaring what one pound due at the end of any number of yeares vnder 31 is worth ready money at* 8 per centum, per annum.

| yeares. | li | ſ | d | q | li. | ſ | d. | q | yeares |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 18 | 7 | 0 | 0 | 5 | 10 | 0 | 16 |
| 2 | 0 | 17 | 10 | 3 | 0 | 5 | 4 | 3 | 17 |
| 3 | 0 | 15 | 1 | 2 | 0 | 5 | 0 | 0 | 18 |
| 4 | 0 | 14 | 8 | 1 | 0 | 4 | 7 | 2 | 19 |
| 5 | 0 | 13 | 7 | 1 | 0 | 4 | 3 | 1 | 20 |
| 6 | 0 | 12 | 7 | 0 | 0 | 3 | 11 | 2 | 21 |
| 7 | 0 | 11 | 8 | 0 | 0 | 3 | 8 | 0 | 22 |
| 8 | 0 | 10 | 9 | 2 | 0 | 3 | 4 | 3 | 23 |
| 9 | 0 | 10 | 0 | 0 | 0 | 3 | 1 | 3 | 24 |
| 10 | 0 | 9 | 3 | 0 | 0 | 2 | 11 | 0 | 25 |
| 11 | 0 | 8 | 6 | 3 | 0 | 2 | 8 | 1 | 26 |
| 12 | 0 | 7 | 11 | 1 | 0 | 2 | 6 | 0 | 27 |
| 13 | 0 | 7 | 4 | 0 | 0 | 2 | 3 | 3 | 28 |
| 14 | 0 | 6 | 9 | 2 | 0 | 2 | 1 | 3 | 29 |
| 15 | 0 | 6 | 3 | 2 | 0 | 1 | 11 | 3 | 30 |

This *third Table* is diſpoſed as the *firſt*, the vſe according to the *title* thereof, being *damageable*.

## 1 Example.

*Suppoſe there is* 750 li *due to be payed at the end of* 9 *yeares, the Creditour would ſell this debt for preſent money, what ought that money to bee at the rate deſcribed in the table.*

Seeke in this *third Table* for 9 *yeares* at the *left ſide* of the *Table*, and right againſt it toward the right hand, you ſhall finde 10 *ſhillings*, which multiplied or taken 750 times, yeeldeth 7500 *ſhillings*, which is 375 li. the value of that *debt* in preſent *money*.

## 2 Example.

*There is a Leaſe worth* 500 li. *after the end of* 7 *yeares; what is it worth preſent money, according to the rate deſcribed in the table ſtaying till it fall.*

I ſeeke in the *Table* for the 7 *yeare*, and right againſt it I finde 11 ſ——8 d; now I multiply 500 by 11, it yeeldeth 5500 *ſhillings*, or 275 li. then 500 times 8 d. maketh 4000 d, which is 16 li——13 ſ——4 d, which added together is 291 li——13 ſ——4 d. the value of the *Leaſe* to be payed before it fall in hand.

| li | ſ | d | o |
|---|---|---|---|
| 275 | 0 | 0 | 0 |
| 16 | 13 | 4 | 0 |
| 221 | 13 | 4 | 0 |

The

*The fourth Table expressing what one pound yearely rent or annuity for any number of yeares not exceeding 30, is worth ready money at 8 per centum, per annum.*

| yeeres. | li. | s. | d. | q. | li. | s. | d. | q. | yeeres. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 18 | 6 | 0 | 8 | 17 | 0 | 1 | 16 |
| 2 | 1 | 15 | 7 | 3 | 9 | 2 | 5 | 0 | 17 |
| 3 | 2 | 11 | 6 | 2 | 9 | 7 | 5 | 1 | 18 |
| 4 | 3 | 6 | 2 | 3 | 9 | 12 | 0 | 3 | 19 |
| 5 | 3 | 19 | 10 | 1 | 9 | 16 | 4 | 1 | 20 |
| 6 | 4 | 12 | 5 | 1 | 10 | 0 | 4 | 0 | 21 |
| 7 | 5 | 4 | 1 | 2 | 10 | 4 | 0 | 0 | 22 |
| 8 | 5 | 14 | 11 | 0 | 10 | 7 | 5 | 0 | 23 |
| 9 | 6 | 4 | 11 | 1 | 10 | 10 | 6 | 3 | 24 |
| 10 | 6 | 14 | 2 | 1 | 10 | 13 | 5 | 3 | 25 |
| 11 | 7 | 2 | 9 | 1 | 10 | 19 | 2 | 1 | 26 |
| 12 | 7 | 10 | 8 | 2 | 10 | 18 | 8 | 1 | 27 |
| 13 | 7 | 18 | 0 | 3 | 11 | 1 | 0 | 0 | 28 |
| 14 | 8 | 4 | 10 | 2 | 11 | 3 | 2 | 0 | 29 |
| 15 | 8 | 11 | 2 | 1 | 11 | 5 | 1 | 3. | 30 |

The *fourth Table* is disposed altogether as the former, and the vse thereof in like sort being *damageable*.

## 1 Example.

*There is an annuity or rent of* 20 *l.* per annum, *to endure* 25 *yeares, it is required what it is worth ready money?*

Looke in the *Table* for the 25 *yeare*, and right against it you shall finde 10 li-13 s-5 d-3 q. which is the solution.

## 2 Example.

*What is the lease of certaine land valued at* 140 li. per annum, *to begin presently and endure* 18 *yeares, worth ready money?*

Search in the *Table* for 18 *yeares*, the *terme* named in the *question*, and right against it toward the left hand you shall finde 9 l—7 s. 5 d—1 q. which expresseth that *one pound rent* to bee bought for that *terme* is worth so much; therefore that summe 140 times is

the value required; Now
140 times 9 li is 1260, and 140 times 7 ſ is 980 ſ or 49 li; likewiſe 140 times 5 d is 700 d or 2 li —18 ſ—4 d. and 140 *farthings* is 2 ſ—11 d. all which added together make 1312 li—1 ſ 3 d. for the value of the ſaid *leaſe*, paying no *rent*.

| li | ſ | d |
|---|---|---|
| 1260 | —0 | —0 |
| 49 | —0 | —0 |
| 2 | —18 | —4 |
| | 2 | —11 |
| 1312 | —1 | —3 |

## 3 Example.

*A leaſe taken for 21 yeares at* 13 li—6 ſ 8 d per annum, *which after 5 yeares expired, the tenant is deſirous to giue a fyne, and bring the rent downe to* 8 li per annum *for the reſt of the terme: the demand is what fyne is to be payed?*

Subtract 5 *yeares* from 21, the remaine 16, is the time vnexpired; likewiſe from the preſent *rent* abate 8 li, the reſt will be 5 li-6 ſ-8 d. now the drift of the *queſtion* is, what 5 li—6 ſ -8 d. *yearly rent or annuity* to endure 16 yeares is worth preſent money?

The value of 1 li *rent or annuity* anſwering to 16 *yeares* is 8 li—17 ſ—0 d—1 q. Now

5

5 times 8 li. is 40 li. and 5 times 17 ſ. is 4 li. —5 ſ. and 5 times one *farthing*, is 1 d. —1 q. and becauſe 6 ſ—8 d. is $\frac{1}{3}$ of 1 li. I take $\frac{1}{3}$ of 8 li—17 ſ. —0 d—1 q. which is 2 li–19 ſ—0 d. all which added together, make 4 li–4 ſ–1 d–0 q. which is the *fyne* that ought to bee paid to bring the *rent* to 8 li. *per annum*.

| li | ſ | d | q |
|---|---|---|---|
| 40 | 0 | 0 | 0 |
| 4 | 5 | 0 | 0 |
| 2 | 19 | 1 | 2 |
| 47 | 4 | 1 | 2 |

*The fifth Table declaring what yearely rent or annuity one pound ready money will purchase for any number of yeares under 31, at 8 per centum, per annum.*

| yeeres | li. | s. | d. | q. | li. | s. | d. | q. | yeeres |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 7 | 0 | | 2 | 9 | 3 | 16 |
| 2 | | 14 | 0 | 0 | | 2 | 8 | 3 | 17 |
| 3 | | 9 | 8 | 2 | | 2 | 8 | 0 | 18 |
| 4 | | 7 | 6 | 2 | | 2 | 7 | 0 | 19 |
| 5 | | 6 | 3 | 0 | | 2 | 6 | 2 | 20 |
| 6 | | 5 | 4 | 3 | | 2 | 5 | 3 | 21 |
| 7 | | 4 | 9 | 2 | | 2 | 5 | 1 | 22 |
| 8 | | 4 | 4 | 0 | | 2 | 4 | 3 | 23 |
| 9 | | 4 | 0 | 0 | | 2 | 4 | 1 | 24 |
| 10 | | 3 | 8 | 2 | | 2 | 4 | 0 | 25 |
| 11 | | 3 | 6 | 0 | | 2 | 3 | 3 | 26 |
| 12 | | 3 | 3 | 3 | | 2 | 3 | 1 | 27 |
| 13 | | 3 | 1 | 3 | | 2 | 3 | 0 | 28 |
| 14 | | 3 | 0 | 1 | | 2 | 2 | 3 | 29 |
| 15 | | 2 | 11 | 0 | | 2 | 2 | 2 | 30 |

In the fifth *Table* the *numbers* and *columnes* are all diſpoſed as the former *Tables*, and needeth no further explanation but onely *Examples*.

## 1 Example.

*The Table declareth at firſt ſight what yearly rent or annuity one pound ready money will purchaſe for any terme in the Table expreſſed.*

But if the *ready money* be aboue one pound, then if any *value or rent* ſet downe in this *Table*, be multiplyed by the *number* belonging to the *yeartes in queſtion*, the *product* will ſhew what *yearly rent or annuity* that *ready money* will purchaſe for the *time propoſed*.

## 2 Example.

*A certaine man hath 750 li. to purchaſe an annuity to endure 27 yeares, ſo as it may yeeld him the like profit, as if it were put out according to the rate in the Table expreſſed, it is required what that annuity ought to be?*

Becauſe

Because the *annuity* is to endure 27 *yeares*, seeke out the *value or rent* set against 27 *yeares* in this *fift Table*, which is 2 ſ—3 d—1 q; now this being the *annuity* 20 ſ. *ready money* will *purchase* for that *terme*, it must bee multiplyed by 750 li as followeth: becauſe 2 ſ is the tenth part of 20 ſ. therefore take the tenth part of 750 li. which is 75 li. which set first downe, then 750 times 3 d. is 9 li—7 ſ—6 d, which set vnder the former, last of all 750 *farthings* is 15 ſ—7 d—ob, All which added together, produce 85 li—3 ſ—1 d—ob, the *yearely annuity* required.

| li | ſ | d | q |
|---|---|---|---|
| 75 | 0 | 0 | 0 |
| 9 | 7 | 6 | 0 |
| | 15 | 7 | 2 |
| 85 | 3 | 1 | 2 |

*Deo ſoli laus omnis honor & gloria tribuatur. Amen.*

FINIS.

In Great Saint *Bartholomewes* in the new street, is taught by *Robert Hartwell* Practitioner in the Mathematicks, the *Arts*, *Sciences*, and *Faculties* here-under expressed.

- Arithmeticke.
  - IN whole Numbers and Fractions.
  - The Extraction of Roots, viz. Square, Cube, Squared square, Surfolid, } At one operation.
  - Of Astronomicall or Physicall Fractions.
  - Of proportion.
  - The Rules of Aequation, with Cosse, or Algebra.
- Geometry
  - Principles with practise and Demonstration.
  - Measuring of Land, and reducing of Plots or Maps to any proportion.
  - Plotting of countries with diuers and sundry instruments.
  - Measuring of any superficiall or solid content. Board, Glasse, &c. Timber, Stone, &c.
- The doctrine of Triangles. Plaine and Spherically. With the vse of the Tables of Sines, Tangents, Secants, and Logarithmes
- viz
  - Description, Demonstration, and vse of Instruments, viz. Quadrant, Quadrat, Theodelite, plaine Table, Circumferenter, Pantometer, Circular Scale, M. Gunters Sector and propottionall Ruler (by him) conuerted into a Crosse Staffe for Sea-mens vse.
  - Navigation. Principles thereof, with the making and vse of sundry instruments fitting that Art. The vse and proiection of Maps and Charts.
  - Vse & demonstration of The Sphere or Globe both Terrestiall, and Coelestiall. Coelestiall Globe in plain, by M. D. Hood. All sorts of Astrolabes, and M. Blagraues Iewell.
  - *Dialling* of all sorts, viz. Fixed, and Instrumentall. aswell Geometrically, Arithmetically, as Instrumentally.
  - Accompts for Merchants by order of Retayle of all sorts. Debitor & Creditor.
  - Perfecting of Accompts in Controuersie.

*Fide* *sed* *Vide.*